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The Geographical Journal.

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The

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GEOGRAPHICAL ASPECTS OF THE PROBLEM OF EMPIRE COTTON GROWING.*

By J. HOWARD REED.

"Year by year we are gradually approaching a very serious crisis, as the shortage of cotton is regular and progressive, and unless supplies of raw fibre are obtained from other fields than those of America, the Lancashire industry will not only gradually languish and decay, but will completely perish. For this reason it has become all-important that the industry of cotton-growing in British colonies should be fostered and developed, and if the effort is not abundantly successful within a few years, the great staple trade of Lancashire is doomed."

The statement just quoted was made in the course of an address I had the honour of delivering before Section E (Geography) at the meeting of the British Association, held in Sheffield in September last. The vast importance of the subject, and the extreme gravity of the pronouncement made, excited comment throughout the Press of Great Britain, and the statement was referred to by newspapers published in our great Indian dependency. In no case that has so far come under my notice has any exception been taken to the sweeping pronouncement, and I think, therefore, that I am justified in believing that its general accuracy is accepted by those best qualified to judge.

It is, I take it, to the great importance of the cotton problem from a material and economical point of view, and to its very special geographical bearing, that I owe the invitation to prepare and read this paper before the Royal Geographical Society. I value the honour very highly, and shall do my best to justify the confidence which has been reposed in me.

My main purpose will be to consider the geographical aspects of the

* Royal Geographical Society, December 5, 1910.

problem of cotton growing within the Empire; but I may, perhaps, first be permitted briefly to call attention to the main factors which have produced the present situation, and made the production of raw cotton within British dominions all important.

Not many years ago the cotton crops of the world were quite sufficient, season by season, to meet the whole demand of the cotton-spinners, with a margin of surplus, which tended to keep the price regular and reasonable. At that time Lancashire to all intents and purposes manufactured cotton goods for the world, the whole output of other countries being comparatively unimportant. Then, as now, the American cotton-fields supplied about 80 per cent. of the raw cotton required in Britain, all the other cotton fields of the world contributing between them the other 20 per cent.

Even so recently as the season of 1882–3 the crop of American cotton reached less than seven million bales, but this, supplemented by the smaller crops of other countries, was sufficient to meet the combined demands of the mills of Great Britain, the Continent of Europe, and the United States, and to supply a surplus of about a quarter of a million bales. While these conditions prevailed the price of cotton remained fairly constant and reasonable, and the panics of recent years were scarcely known, and never so serious as now.

The demand of Britain for raw cotton is no greater to-day, but slightly less than it was, say, twenty-five years ago, and the weight of the American crop has steadily increased in the mean time.

In this connection it may be mentioned that while the crop of cotton produced in the United States in 1882–3, as just stated, reached less than seven million bales, it had by 1892 increased to over nine millions, and ten years later it reached ten and a half millions, while the crop of 1908–9 totalled over thirteen and three-quarters millions, although it fell back again last season to not much over ten and a half millions of bales. Notwithstanding this fairly steady increase, however, we find that the condition of "shortage" is, generally speaking, getting worse, and has now become almost chronic; so much so, indeed, that the price of the raw commodity has advanced practically to double what it was not many years ago. The difficulty is intensified by the opportunity which "shortage" affords to gamblers across the Atlantic to "corner" the supplies, and to still further force up the price; and of which opportunities the gentlemen referred to do not fail to take full advantage.

If, as has been previously stated, the British demand for raw cotton has slightly decreased during the past twenty years, while the American crops, and the total of the world's production, has been steadily increasing, how, it may be asked, is it that cotton users are so seriously suffering from "shortage"? In reply it may be concisely stated that the trouble is due to the enormous growth of cotton manufacture in other countries, which has produced a hunger for raw fibre which cannot now be adequately satisfied.

This will be perfectly clear when the following figures are considered. In 1891–2 Britain, to supply her spindles, used 3,181,000 bales of cotton, Europe used 3,640,000 bales, while the mills of the United States required only 2,431,000 bales. Last year (1909–10) Britain used 3,053,545 bales (which is 127,455 bales less than the 1891–2 figure), Europe consumed 6,186,930 bales, and the United States of America used 4,707,000 bales. In other words, during the eighteen years under consideration the demand of Britain for raw cotton has fallen 4 per cent., while in Europe the call for fibre has increased during the same period 70 per cent., and this on a figure which at the earlier period referred to was already nearly half a million bales larger than that of this country. In the United States the demand has increased by no less than 90 per cent. within the same period. If taken a year earlier, the figures are even more startling. Then Great Britain showed a decrease of only 1 per cent. during seventeen years, but Europe and the United States showed an increase of 75½ and 109 per cent. respectively.

The fall during the last year quoted was doubtless brought about by the smaller crop and a consequently enhanced price of raw cotton, by a general slackness of trade during that season, and more especially by the organized scheme of short-time working which has been more or less generally adopted by the cotton manufacturers of the world.

The American fields, for reasons which we cannot deal with here, cannot be expected to keep pace with the increasing demands of the cotton-using world. It is fairly obvious that, if the requirements of the American mills continue to increase as they have in the past, it will be the countries on this side of the Atlantic that will most severely feel the pinch of "shortage," as naturally the home mills in the neighbourhood of the native cotton fields will have their needs supplied before the manufacturers in the Eastern hemisphere get a chance.

The other well established though much smaller cotton-fields of the world are even more impotent to prevent "shortage." The fields of India, for instance, which rank next to those of America, and have an output of between four and five million bales of fibre, produce a short-stapled variety not of much use in this country. About one-third of the Indian crop is used in the home mills, large quantities go to Japan and Germany, and the remainder, in comparatively small consignments, is sent to the other countries of Europe, including Great Britain.

The cotton produced in Brazil, Peru, Mexico, Asiatic Russia, China, Japan, and Korea is almost wholly absorbed locally, and many of the countries mentioned also import considerable quantities of fibre from America and India. Japan, for instance, last year consumed 130,000 bales of American cotton in addition to 914,000 bales of Indian.

No great increase is to be expected from Egypt, as the land available for cultivation is very limited, and even with the irrigation works completed, the increased acreage available for cotton will be very small. Indeed, as

has been pointed out, cotton growing in Egypt proper has practically reached its limit.

Enough has probably been said to emphasize the now well known fact that there is a great need for increased supplies of raw cotton being obtained from somewhere, and to satisfy us that there is very little prospect of this increase being obtained from the present well-established cotton-fields of the world.

It was the gradual realization of the facts just stated, brought about by careful study and inquiry, which led to the formation of the British Cotton Growing Association. I do not propose to describe in any detail the work undertaken and accomplished by this association, but I may perhaps be permitted to say that its operations have been of a most satisfactory character. Though handicapped by lack of enthusiasm, and a very tardy supply of the comparatively small financial assistance asked for, it has performed a monumental work, and its founders and supporters will deserve all credit when the great problem of Empire cotton production has been solved.

Before attempting to describe what has actually been accomplished in the matter of cotton cultivation within British colonies, or dealing with the future prospects of the all-important project, it may be useful to consider some of the main facts and conditions upon which the success of the movement is dependent.

It is quite well known that what may be described as the cotton-growing belt embraces all the land areas falling within a zone extending between 40° N. and 40° S. of the equator. This region, it will be observed, embraces practically the whole of the British Empire except Canada, Tasmania, and part of New Zealand, and quite obviously gives enormous scope for the possibilities of cotton growing in British Dominions; seeing that the zone includes the whole of the tropical and semi-tropical possessions of the Empire.

There are, of course, many conditions besides latitude upon which the successful growth of cotton depends. The soil must be suitable, the rainfall sufficient, or irrigation at reasonable cost possible.

In the American fields various types of soils exist—clayey, loamy, and sandy, or combinations in varying proportions of any two of these—and each of them, when properly dealt with, is found suitable for some particular variety of cotton plant. It is evident that if all these various kinds of soils have been found more or less suitable for cotton culture in America, that similar surface conditions within British territories will be equally suitable, provided that other necessities are likewise in existence.

Professor Dunstan, the well-known authority on these matters, speaking of the British territories which fall within the cotton-growing zone, says: "The rainfall in most of these countries is adequate, and in those in which it is deficient, irrigation is possible in nearly every instance." He goes on to say that: "Records of temperature and rainfall being available,

the suitablity of the climate for successful cultivation can be readily gauged, and the best time for both planting and gathering of the crops determined." He remarks that: "The suitability of the soil is more difficult to determine, especially in relation to the necessity of manuring, and to the proper rotation of crops." This, however, is, after all, a matter of detail, with which it is not necessary to deal until a special inquiry with regard to the suitability of some particular area, with a view to cotton cultivation, comes under consideration.

The varieties of cotton which are suited to particular regions is a very much larger question; but this, again, only needs to be closely considered when the general suitability of some district has been determined, and can in most cases be best settled within a few seasons by actual experiment with different kinds of seed, and methods of manuring, planting, watering, etc.

The world produces cottons of what may without exaggeration be described as unnumbered varieties—there are, it has been stated, no less than 130 kinds of American. A seed which produces a plant and fibre of certain definite characteristics when grown in a particular way in one country, produces a more or less modified result when treated in another manner, or when cultivated under varying conditions in some other part of the world. Although this is so, the various kinds have, I believe, been classified into six general species, all the innumerable varieties falling somewhere within the scope of one or other of these.

The six classes referred to are as follows:—

1. *Gossypium barbadense*, the well-known silky and long-stapled variety known generally as the sea-island cotton of America, and which has been improved under the special conditions in Egypt into the very valuable variety for which the land of the Nile is famed. It is indigenous to the West Indies, and is said to have been introduced into the United States from Barbadoes, from which island its name is evidently derived. The cotton-fields of the United States bordering the sea-coast produce large quantities of this particular fibre, hence the name—sea-island cotton.

2. *Gossypium herbaceum*, more or less indigenous to India, China, Asia Minor and Africa, and probably originally derived from the first-named country.

3. *Gossypium hirsutum*, so named from the hairy character of every part of the plant, which is believed to have been originally native to Mexico. It is now found in practically all sub-tropical regions.

4. *Gossypium arboreum*, a tree cotton, as its name implies, grows to as much as 20 feet in height. It is indigenous to India and the borders of the Indian ocean, and yields a fibre of short staple.

5. *Gossypium neglectum*, which produces a short stapled white fibre of somewhat harsh character. It is native to India, and grows in the form of a low kind of bush, less than 2 feet high. It is of great commercial importance to India, as it is produced in large quantities in the

Punjaub, and the North-West Provinces, and contributes the largest share to the cotton grown in the Bengal Presidency.

6. *Gossypium Peruvianum*. This, as its name suggests, comes from Peru. It is largely cultivated in that country and in Brazil, being grown both as a tree and as an herbaceous plant. What is known as kidney-cotton, so called from the shape and arrangement of its seeds, belongs to this species.

Doubtless, when cotton has been cultivated on scientific principles and under the guidance of experts, in our various colonies, new varieties, specially suited to chosen districts, will be developed which will give the most certain and useful results obtainable in those particular areas.

There are many conditions, it need hardly be said, besides those which have been already briefly referred to, upon which the success of cotton culture within the British Empire will depend. A sufficiency of suitable native labour will be of paramount importance in the development of Imperial cotton-fields, and the particular conditions, habits, and racial aptitudes of aboriginal tribes will have an enormous bearing upon the whole subject.

Means of transport and communication will be a primary condition essential to success, as it is manifest that, however good or plentiful the product of any special district may be, such produce will be an absolute drug in the market unless it can be readily and cheaply transported from its place of origin to the markets where it is required. For this purpose it will be necessary for the extension of railways, the construction of roads, the building of bridges, and the organisation of river and lake transport to keep pace with the progress of the cotton-growing industry in the at present undeveloped colonial areas. Many of the points so briefly referred to will come more or less under notice as we deal with the various districts where cotton growing is already making more or less satisfactory progress.

During the past eight years the British Cotton Growing Association, as is well known, have been devoting themselves assiduously to the encouragement of cotton production throughout the British Colonies. Their operations have embraced extensive inquiry, energetic experimental work, and wide-spread financial assistance, the whole of the branches of their great effort having been distinguished by businesslike intensity of purpose. In some fields disappointment has been met with, while in others great encouragement and success have resulted.

The Association has all along been more or less held back by financial considerations, and there is little doubt that had the capital they originally asked for (£500,000) been forthcoming at an earlier date, they would have accomplished more. In an appeal made to the public a year ago, the Association stated that their "pioneer and initial work" was "practically finished," they having "proved beyond dispute that cotton can be grown within the Empire on a large scale, and on a commercial basis." They stated further, that they had "decided to concentrate their main efforts on Nigeria, Uganda, Nyasaland and the West Indies."

This seems to be a wise decision, not because other parts of the Empire give no encouragement, but simply because the four districts selected show more immediate promise of real success. When the work of cotton growing has been fairly well established in these fields, the concentration of effort can be relaxed, and more direct attention be given to other regions. It will be worth while to devote some little special attention to the four districts just referred to.

The reports of the progress of cotton cultivation in the West Indies are satisfactory and highly encouraging. A century ago the production of raw cotton in these islands was a considerable industry, and somewhere about 70 per cent. of all the cotton used in Great Britain was at that time obtained from there. Later on, the competition of the American fields gradually forced the West Indian planters to turn their attention more vigorously to the production of sugar and other crops more profitable than cotton, the cultivation of which, as a consequence, diminished and afterwards practically ceased.

Since the Cotton Growing Association commenced their work the industry has been re-established, and now gives much promise for the future. The cotton grown is that known as sea-island, which has been re-introduced from the islands off the coast of South Carolina. It is of interest to remember that in all probability this plant was first introduced to the American fields from the West Indies, its botanical name (*Gossypium Barbadense*) suggesting that it came originally from the island of Barbadoes, where to-day larger quantities of this particular variety are being produced than in any other island of the West Indian group.

The colonial authorities have given much attention to the re-established industry, Sir Daniel Morris, K.C.M.G., late Imperial Commissioner of Agriculture, having strenuously devoted himself to the work. Since the revival, the exports of cotton from these islands have steadily increased year by year, while the acreage devoted to cotton crops has been regularly augmented. In 1902 cotton fibre and seed worth £9,676 was exported, but this has now increased to a value of £250,000, there being no less than 30,000 acres under cotton crops. It has been found by experience that cotton is a crop which can be grown in rotation with sugar-cane with satisfactory results.

In addition to the cultivation of the high-class long-stapled sea-island cotton, the colonists have also experimented with other varieties with considerable success. Some of the islands appear to be better suited to the growth of "second" and "third" class grades of cotton, and these find a ready market. The planters of the West Indies have been spoken of in high terms by Sir Daniel Morris, who is evidently convinced that they are devoted to the re-established industry.

It should be remembered that, although most satisfactory developments may be expected in these colonies during the next few years, their opportunities are naturally limited. The whole area of the islands is only some

12,000 square miles (twice the size of Yorkshire), while the population is only about 1,500,000.

Africa probably affords the greatest hope we have for large supplies of all the varieties of raw cotton which are most in demand in this country. One is impressed with the fact that the rapid development of British colonies within the tropical and semi-tropical portions of the great "dark continent," has only really commenced, just at the time when their vast natural resources are likely to be most in demand. It certainly seems as if Africa is destined in the future to provide this country with vast supplies of raw materials and food stuffs, and at the same time supply important new markets for the benefit of our manufacturing and commercial districts.

From the point of view of cotton, no portion of Africa gives greater promise than does that area which contains the whole of our West African possessions. We have here large areas of territory which possess a soil and climate specially suited to the production of cotton, and where, indeed, an extensive native cotton-growing industry has been carried on, probably for many hundreds of years. These districts, too, are densely populated by peoples identical in blood and race with those who are the successful cotton cultivators in the United States. Indeed, it is not improbable that the earliest cotton-fields in the West were those which the slaves from Africa started with the seeds they had brought with them when dragged across the seas to the Western plantations.

The ports of British West Africa are in many cases old established centres of trade, provided with wharfage and other commercial appliances. They are as well within touch of British ports as are the West Indies or the American cotton states, and possess a native trading population whose natural commercial instincts have been well developed by being for generations in touch with British traders.

It may be remembered that cotton growing for export is not altogether a new industry in West Africa. At the time of the great cotton famine, Lagos, like the West Indies, did something to help Lancashire. In the year 1869, raw cotton to the value of nearly £77,000 was exported from this one colony. American competition killed the industry, and we find that ten years later the export had dropped to a little over £500. Recent experiences, however, have shown that the possibilities of West Africa are most encouraging. Each of the West African Colonies has done something in the way of cotton production during the past few years, and all of them, with the exceptions of Gambia and Sierra Leone, give considerable future promise. The colony of Lagos has been the most progressive of the group from the cotton point of view, and during the season of 1909 provided no less than 12,000 bales of fibre out of 13,200, which was the West African total for that year.

The British Cotton Growing Association has expended much money and effort in these colonies. Seed of selected varieties has been liberally distributed, ginneries have been erected and fully equipped, buying

agencies have been established, much experimental work has been carried out with a view to improving the cotton fibre produced, and all kinds of encouragement have been given to the local cultivators in the hope of establishing a native industry on satisfactory commercial lines.

The local authorities, with the approval of the Colonial Office, have done all possible to foster the work and back up the efforts of the Association. Money has been expended in the construction of railways and the general improvement of communications, in the development of experimental farms, and, not least, by pursuing measures of government and administration which have established peace and contentment among the native peoples.

In April last the old arrangements between the Government and the Association came to an end, and a new and progressive scheme was established. By this agreement a sum of £10,000 per year for three years is to be granted from Imperial funds, "the Association undertaking in return to raise a further £150,000 of capital; to continue the work already begun on a commercial basis; to erect and maintain for a period of three years seven pioneering, buying and ginning centres—two in the Gold Coast, one in Southern Nigeria, three in Northern Nigeria, and one in Nyasaland"; "to provide free of charge all seed for growing purposes in the Gold Coast, Southern Nigeria, Northern Nigeria, and Nyasaland; and to carry on travelling and missionary work among native cultivators in the Gold Coast and Southern and Northern Nigeria."

The work that has been done in West Africa, and the undertakings that are now in hand, tell a story of consistent and persistent effort, brimming over with interest and encouragement. The task to be accomplished, however, is so vast, and the ground to be covered so extensive, that much patience and earnest endeavour will be needed for many years to come.

Leaving the West African colonies, and turning to those on the other side of the continent we find much satisfactory work in progress. In Nyasaland the story of cotton cultivation, so far as it has gone, is quite a romance. In the season of 1901–2 experiments were commenced, and in the following year cotton fibre was mentioned as an export from the colony for the first time, but the consignment only reached the trifling value of £3. This at the time appeared so absurdly small that its mention only provoked a smile. The appearance of the item in question was, however, a much more important fact than was then realized, as it recorded the birth of a new and what is now an important industry.

The crop in Nyasaland, and the export of ginned cotton from the colony, has increased year by year, and has now reached encouraging proportions. In the season of 1908–9 raw cotton headed the list of exports in value, no less than £28,353 worth being exported in that year, while nearly 9000 acres of land were under cotton crops for the next season's harvest.

At the end of August last it was officially stated that the cotton industry

was "going ahead by leaps and bounds." It was expected that the area cultivated by Europeans, which was then 12,000 acres, would increase in the following year to over 20,000 acres. The native industry was increasing "even more rapidly," and may be expected to exceed the European acreage and output in a few years.

Different varieties of cotton are cultivated in this colony according to soil, situation, and height of the land above sea-level. What is known as Nyasaland Upland is a very superior type of fibre, and commands a better price than the same class of cotton grown in America. It has been reported to be "the finest cotton ever grown from Upland seed either in America or elsewhere."

The Government authorities and the Cotton Growing Association have worked together to encourage the industry, and their efforts as we have seen, have met with considerable success. In the Nyasaland Handbook it is stated of cotton-growing, "the industry is thoroughly established and gaining in favour with Europeans and natives alike."

In 1905 a most valuable report was issued dealing in detail with the industry of cotton growing in this particular colony. It was the work of Mr. Samuel Simpson, a cotton expert, and was written after exhaustive investigations made on the spot, and it must be of much assistance to the local planters. Scientific work of this kind is being vigorously continued by the Agricultural Department which has recently been enlarged for this special purpose.

The report of the Director of Agriculture for the year 1909–10 is full of most valuable information on suitable varieties of cotton, blights and diseases which affect the plants, and how they may be avoided or mitigated, characters of the varieties grown, methods of selection, etc., and gives a very distinct clue to the helpful and stimulating service which the department is rendering to the colony.

Uganda, the remaining colony of the four upon which the Cotton Growing Association are concentrating their efforts, has proved a most satisfactory field. Hitherto the experiments have been mainly carried out by the Government, who have succeeded in influencing and interesting the native chiefs and impressing upon them the commercial value of the work. The result has been the establishment of a native cultivation which has very rapidly developed most encouraging proportions.

Some difficulty was at first experienced due to the ignorance and inexperience of the people who mixed up different varieties of seed with disappointing results. The Government officials, however, adopted measures to regulate matters and supervised the disposal of seed and the distribution of that selected for planting. They also carried out "experiments with different varieties of cotton, hybridization, acclimatization, and different methods of cultivation." A considerable sum of money has been expended in work of this kind, but the successful results which are now being obtained have fully justified the expenditure.

As is well known the natives of Uganda are a far more progressive type of people than the generality of native African tribes, and this fact has doubtless much to do with the remarkable results which have been obtained. The late High Commissioner, Sir Hesketh Bell, K.C.M.G., has spoken in the highest terms of the progress and probable future of cotton growing in the Protectorate. "We have in Uganda," he says, "one of the greatest cotton-fields in the Empire." The country has "not only the soil, climate, and other natural conditions absolutely favourable to cotton growing," but also a population "eager" for that work. The natives, he states are, "so greedy of progress and improvement that they had almost to be restrained."

Within a few years the exports of cotton from this district have grown from nothing to a value, in 1898, of £50,000, and Sir Hesketh Bell has stated his belief that the industry will increase tenfold in a very few years. In order to keep pace with the progress and enthusiasm of the native cultivators, it will be necessary to extend railway and other transport facilities, and work of this kind is being pushed forward by the authorities. It is evident that Uganda gives great promise for substantial supplies of raw cotton for the future.

There are considerable areas within the East African Protectorate where the climate and soil are suited to cotton cultivation, and fibre of very superior character, judged from the Egyptian standard, has been grown. The Association have spent a good sum of money in stimulating the work in the district, and the Government have also devoted considerable sums to the effort. The crops a couple of years ago largely failed for reasons which cannot now be dealt with, and since then efforts have been relaxed and more attention been given to Uganda. The machinery sent out for Mombasa has instead been erected at Kisumu, on Lake Victoria.

Turning to the Sudan we find large areas of suitable land near to where the Blue Nile and the Atbara join the main stream of the Nile. Many years ago the late Sir Samuel Baker drew attention to this district and its suitability for cotton growing. He pointed out that a superior type of plant, giving a long-stapled fibre, was indigenous to the district, and he suggested that some barrage scheme which would store up the waste waters of the Atbara would render some thirty millions of acres available for cultivation. He pointed out that the seasons in that district were so certain that, to use his own words, "neither rain nor dew disturbs the dryness of the atmosphere, and the freshly gathered cotton requires no covering."

Lord Cromer, in his 1903 Report, says of the same district: "There can be no doubt that cotton, of good quality can be produced in that country. The Sudan was, indeed, the original house of Egyptian cotton."

In the early days of the British Cotton Growing movement an American gentleman, Mr. Leigh Hunt, acquired a considerable tract of land near the mouth of the Atbara river, formed a Syndicate, and commenced cotton growing. Much success followed Mr. Hunt's experiments, and

although three years ago that gentleman retired from the work, it is still being carried on with increased success. Sir William Mather, in an address on the subject delivered in October last in Manchester, spoke in the highest terms of the work already done, and of the great promise for this district in the future. He pointed out that at Zeidab, in the province of Berber there were at present 3000 acres under cotton crops, the same area under wheat, and almost as much under other crops used like wheat in rotation with cotton. The total area of the present concession is only 12,000 acres, but this will shortly be extended to 40,000 acres. The cotton crop was found to command better prices at Alexandria than "fully good fair" Egyptian fibre.

The Gezira plain, between the converging courses of the Blue and White Niles, forms a splendid field for the production of cotton, and is said to be capable of yielding a crop of best quality fibre of probably 700,000 Egyptian bales. The area of the plain in question is estimated at between three and four million acres, or taken at the lower figure, 4500 square miles, which is equal to more than a third of the whole cultivable area of Egypt. Wheat of the finest quality can also be grown in this plain so that two valuable crops can be grown in rotation.

The new railway from the Nile to the Red Sea affords facilities for transport. Barrage works will be necessary in the neighbourhood of Sennar and an extensive system of irrigation canals will also be required, but there should be no great difficulty in raising the capital for these in view of the natural assets which would by such means be made available.

South Africa cannot, so far as the main territories are concerned, be expected to supply much in the way of raw cotton, at any rate, for some time to come, although good samples of fibre have been produced in Cape Colony, Natal and the Transvaal. Labour difficulties will be likely for some time to come to prevent any great development.

Rhodesia, however, gives much promise for satisfactory supplies in the not very distant future. Labour is likely to be found in sufficient quantities, and the climate and soil in several districts are quite suitable. It is believed that there are great hopes of a native industry being developed under European guidance, much on the lines of those in Uganda, Nyasaland, and West Africa, but although good samples of cotton have already been produced the industry is only now emerging from the elementary stage.

The South African Chartered Company have devoted a considerable sum of money to the development of this work, and they invited the Cotton Growing Association to give financial assistance on the same lines, and to undertake the management of a well-considered scheme. This invitation was accepted, an expert was sent into the country, and his reports were found to be so encouraging that arrangements have been made for the establishment of a buying and ginning centre at Kafue Bridge on the Rhodesia Railway, and every effort is to be made to establish the industry.

It will have been realized from what has been said that Africa promises

in the future to supply a large share of the raw cotton which is required if the British cotton industry is to be saved from disaster, and from this point of view the "dark continent" has not inaptly been described as "Lancashire's hope."

Outside of Africa, and apart from the West Indian fields with which we have already dealt, there are large areas of the British Empire which can and do grow cotton, and which may be expected in the future to do something to meet the needs of the mother country. Time, however, will not allow us to do more than merely glance at these.

India and Ceylon will doubtless under special guidance and Government attention do something to improve the general quality of the fibre they produce, but much native prejudice and natural conservatism will have to be broken down. The short stapled cottons grown by the native Indian cultivators give much heavier crops than the higher class varieties which are in demand in this country, and so far the native growers do not seem disposed to risk a reduction of quantity for the sake of better quality.

In the district of Sind cotton from Egyptian seed has been grown with considerable success. In 1909 some 2500 bales (400 lbs. each) of this cotton were produced. The true secret of the production of a better Indian cotton seems to be the gradual improvement of the native seed by selection and special cultivation under the guidance of trained experts.

Some few months ago an influential deputation of cotton manufacturers and others interested waited upon Lord Morley and requested assistance from the Indian Government with a view to the improvement of the fibre obtained from the Dependency. No great satisfaction was obtained, although the Minister was most sympathetic. The requests made by the deputation may be summarized as :—

The establishment of cotton departments with suitable staffs in each Province. Concentration upon indigenous cottons. Selection of seed. Importation of fertilizers. Imperial financial grants in aid of the work. Lord Morley pointed out that expansion of agricultural production could not be brought about rapidly; that the funds of the Indian Government are not unlimited, and that it would not do for the Government to concentrate its energies upon a single branch of production. He remarked that a Department could do a great deal less than was supposed, but it could do something, and he promised that that "something," whatever it might be, should receive the consideration of the Agricultural Department of India.

Cotton has been grown in Ceylon for a long time, but only in a primitive manner by the natives for their own purposes. The Government and the Cotton Growing Association have spent considerable sums of money in experimental work, and in the equipment of a ginning plant. If the authorities continue their efforts it is hoped that a useful native cotton-growing industry may be established in the north of the island.

The other possible British cotton countries are Australia, Borneo,

Fiji, Straits Settlements, Malay States, the Seychelles, Mauritius, Cyprus, the Maltese islands, and St. Helena, but no great output of fibre is to be expected from either of these districts, at any rate, for some time to come.

In Australia, the provinces of New South Wales, South Australia, and Queensland can all grow cotton of good quality, and the same may be said of New Guinea. No great progress with the industry has, however, been made, nor is such immediately likely, owing to the lack of suitable labour. At present the production of established and more remunerative branches of agriculture absorb all the available workers. Experiments, however, are still being carried on, and some cotton fibre is exported. British Borneo is, perhaps, a more hopeful field, as labour there should be fairly plentiful, and a native cotton is grown for local purposes which is said to be practically equal to that of Egypt, being of specially fine and strong character.

In the Fiji Islands good cotton can be grown, which is noted for its whiteness, long staple, and silky gloss. A generation ago a considerable quantity of fibre came to this country from these islands, and so late as 1873, about £93,000 worth of Fiji cotton was exported. The industry received much stimulus during the great cotton famine period, and a considerable quantity of sea-island fibre was grown. The return of peace, and the resumption of cotton growing in America caused the output to fall off, careless cultivation did the rest, and the industry practically disappeared. Recent experiments have shown good results, and past experience suggests some promise for the future.

In the Straits Settlements and the Malay States cotton has been cultivated, but with poor results. The climatic conditions are variable and unsuited to cotton, the plants are specially liable to suffer from many kinds of parasites, and the supply of labour is deficient. The natives of Mauritius and Seychelles grow cotton on a small scale for their own use. Samples of this have received approval in England, and there is hope that a useful output may some day be obtained.

The island of Cyprus is capable of producing a good variety of cotton, and in past years considerable cultivation was carried on, much fibre being exported to France and the Levant, and small quantities to England. Lack of water, poor seed, locusts, and general neglect practically destroyed the industry, but it was revived by the introduction of better seed and a system of irrigation. Under proper expert care the island may in time do a good deal to assist matters.

Malta, and St. Helena, although so far apart, both grow cotton of useful character. In each case, however, it is only at present grown to meet local needs, and although under suitable direction and stimulus the produce can doubtless be much increased, the possible area for cultivation is necessarily very limited.

From our general knowledge of this subject, and from our discussion of it this evening, I think there will be a general agreement that the

problem of Empire cotton growing is an extremely important one, and that the continued commercial prosperity of a large portion of this country is of necessity greatly dependent upon its solution.

I think we may further agree that various portions of the king's dominions are climatically well capable of contributing something towards the large supply of raw cotton which we need, and that some of the colonies give distinct and hopeful promise for the future. The energetic operations of the British Cotton Growing Association have produced eminently satisfactory results. The work they have done has been of a most praiseworthy character, but after all what has been accomplished is extremely small compared to what is actually required, if the great cotton industry of Britain is to be saved.

We require three and a quarter millions of bales of raw cotton, each of 500 lbs. weight, every year to keep pace with the present demand of our spindles. During eight years the combined efforts of the Cotton Growing Association and the Government authorities in the various colonies have only succeeded in producing 116,700 bales of 400 lbs. weight each, which it will be seen is only one-thirty-fourth of what is required each season.

Something has been done, progress has been made, and the British Cotton Growing Association may be congratulated upon the good work they have accomplished. Much more, however, is needed, and if the problem is to be satisfactorily solved, all those interested will need to do their part, to do it at once, and with energy and persistence.

It has often been said in north of England circles that geography in Lancashire is spelt c-o-t-t-o-n ; this may be so, but if it is, I would remark that so far it has only been interpreted as meaning the export of manufactured cotton. If, however, the industry is to be saved, it is necessary that not only Lancashire, but the whole country should realize that a wider interpretation is required, and that in this sense geography must also mean the importation of raw cotton.

So far, Lancashire and Britain generally have been asleep with regard to this great problem. For eight years the pioneers of the Empire cotton growing movement have been appealing for half a million of money, and even as this is written, the sum is not complete. The money could, and should have been subscribed within a few months at most. What is half a million of money in comparison with the salvation of an industry worth to the country over £100,000,000 per annum ?

It is questionable if the expenditure of £500,000 is anything like enough to establish the industry of cotton growing within the Empire, or whether a sum of £5,000,000 is not more like the figure required. Whatever the necessary amount may be, however, it should be forthcoming, and will have to be found. An increased supply of raw cotton is an imperative necessity, and it must be obtained, or the staple industry of Lancashire will decline and decay, even if it does not ultimately entirely disappear.

The PRESIDENT (before the paper): Mr. Howard Reed, a Fellow of our Society, has kindly consented to lecture to us to-night on the geographical distribution of lands suitable for cotton growing in the British Empire—a subject which he has already discussed at a meeting of the British Association. Mr. Reed is Vice-President and Hon. Secretary of the Manchester Geographical Society, and in that great centre of the cotton manufacture of England he has had exceptional opportunities for studying this subject, and he has taken full advantage of those opportunities. There is only one other point in connection with our lecturer which I cannot help mentioning to-night. There is in connection with the Manchester Geographical Society an inner group or club—I am not quite sure what the title should be—called the Victorians. The Victorians go about lecturing on geographical subjects wherever they can get a platform, and wherever they can spread the desire for the knowledge of geographical subjects. Of this most admirable institution Mr. Reed has been honorary secretary for some time, as well as one of its most active members. In these circumstances, I am sure we shall all listen to him with interest.

Prof. WYNDHAM DUNSTAN: Mr. Howard Reed has given us a very interesting and instructive paper. It deals with a subject which is not only of geographical interest, but also of very considerable imperial importance. It is unnecessary for me to take up your time to-night by fully discussing the various aspects of this great problem, especially as this week a report of mine on the cotton cultivation of the world has been issued.* There are one or two points of special interest from the geographical point of view. First, in any moderately hot country, cotton can be successfully grown provided that the soil is suitable and there is a sufficiency of rain at the right season. These are the conditions in the southern states of America. Even if rain is absent however, cotton can be equally successfully grown, that is, if recourse can be had to irrigation. That is the present position in Egypt. Another point of some geographical interest is that the majority of cotton which is wanted by Lancashire is not at present obtained from the tropics, but from two countries in the sub-tropics, namely, United States and Egypt. Now, the explanation of this probably is that for many years the cotton-growing industry in both these countries has been more or less under resident European control and management; that, as we all know, is the case in the southern states of America, but perhaps it is not so well known how much cotton cultivation in Egypt owes to the work of the French in the early years of last century. Lancashire, and Europe generally—for, as Mr. Reed has said, the quantity of cotton required in other countries than Great Britain for manufacturing purposes is going up by leaps and bounds—now needs a fine cotton, which as a rule is not produced in the tropics. One reason for this is, that, in the tropics proper, where there is often a large native population, and where the white man cannot reside permanently, only a coarse kind of cotton is grown for native use which is quite unsuitable for European manufacture. What is required is to show the natives, with whom the actual cultivation must rest, how to grow better cotton, better from their point of view as well our point of view, because they will get a better price for it, and as far as possible to extend the area which is under cotton. There is an indirect way by which this result is being brought about at the present time. Owing to the transport facilities which are now being provided in West and East Africa, large quantities of European manufactured

* 'Report on the Present Position of Cotton Cultivation,' published by the International Association of Tropical Agriculture.

cotton goods are coming into the tropics. The native is rather attracted by them; they are very often got up in a fashion which suits his eye, and he is purchasing them in increasing amount. The result of that movement may be that the native will not be so inclined as he has been to grow the coarse cotton and manufacture his own goods from it. We may therefore look upon this process, which will be accelerated in West Africa by the opening of the new railway in Northern Nigeria, as promoting the object we have in view, because the area which is now required for growing the coarse cotton may eventually be employed for growing cotton of the kind Lancashire and Europe want. This is the general position in India and West Africa. There we wish to improve the kind of cotton grown, to teach the native how to grow better cotton, and also to increase the area which is at present devoted to the crop. To accomplish this two agencies are needed. There must be continuous experimental work under scientific direction, and this is best conducted under Government auspices through well-equipped Agricultural Departments in the colonies. It often takes a long time to establish a particular kind of cotton in a country, and it is unlikely that as a rule private enterprise will be able to give either the time or the money to this kind of work. There is, therefore, a distinct sphere of action for the Government, and on the other hand for another kind of work for such organizations as the British Cotton Growing Association, which can do best service by providing facilities for buying, so that the natives may receive a satisfactory price for the finer kinds of cotton they have been taught to grow. It is right that the Government should subsidize the British Cotton Growing Association; but it is equally important that Government should also subsidize and make thoroughly efficient the Agricultural Departments in the colonies so that the scientific work on cotton cultivation, without which we shall never reach success, may be efficiently and continuously carried on. It is essential that we should realize that the attempt to produce within the British Empire the large quantity of cotton which is needed in order to render Lancashire more or less independent of the American supply is a gigantic undertaking, and is not likely to be successful unless many years of patient and continuous scientific and commercial work are given to the subject.

Prof. LYDE: In face of the President's request for remarks to be as brief as possible, and of the fact that Mr. Reed left out more than half his paper, it is neither fair nor possible to criticize it, especially as I am absolutely opposed to it; but I cannot admit that a summary of the political distribution of cotton may pass for a contribution towards "the Geographical aspects of cotton-growing." What was needed was discussion of the soil, climate, varieties of the plant, etc. For instance, the soil at ploughing-time, for all annual cottons must be thoroughly damp, but not soppy, *i.e.* not dominated by monsoon downpours; and as cotton, like sugar-cane, needs lime and salt, we have a suggestion for rotation of crop. Again, in early growth the plant wants a warm air humid enough to "blanket" the ultra-violet actinic rays while admitting the infra-red heat rays, but only occasional showers. It does not want excessive temperatures, on which all monsoon phenomena depend, and yet it needs bright sunshine, *i.e.* a comparatively high altitude or high latitude. And it needs a dry harvest-time, so that it is useless to spend money in trying to grow it where there is no proper dry season, as in parts of South Nigeria. Then primeval cotton, like primeval man, was arboreal, and we can still grow it as a perennial. We get our word *calico*—and it is "calico" cotton we want—from Calicut. There are 400 miles of the humid Malabar coastland north of Calicut and 200 miles south of it which could easily raise 500,000 lbs. of calico cotton

a year if the planters were not obsessed by rubber. That cotton could be landed in Liverpool at less than a total cost of 20*s.* per cwt., and Bolton would give 56*s.* per cwt. for it. As to annual cottons, those from trade-wind areas are bound, *cæteris paribus*, to be better than any monsoon products because their climatic processes are gradual and normal, and better than any irrigation cotton because quality varies with the relation of the infra-red to the ultra-violet rays, *i.e.* with the humidity. Egypt is an exception, because there you have a broad river in a narrow trough between white scarps, which help to concentrate such heat on the river that phenomenal evaporation gives the trough exceptional humidity, as evidenced by the fact that the sky—except during the Khamsin—is normally mellow and luminous, not hard and brazen.

This is not meant as a criticism of the paper, but merely as a protest about the topics which such a title ought to have involved.

Mr. A. G. Boyle: I do not think I can add very much to what has been said, but there is one little point which I should like to impress upon most people, and that is that in tropical Africa it should not be the white man who should do the actual planting. I believe it to be far more important that we should teach the black man what he should do in planting cotton for himself and leave the white man to see that he does it than that the European should start plantations on his own. I noticed in one of the pictures that a white man was supposed to be at the handle of the plough. As a matter of fact, I believe it to have been a black man, but I should like to urge once more that it lies on us far more to educate the black man up to the correct methods of planting than to hope in any way that Europeans can work with their hands in the greater part of tropical Africa where cotton grows.

Dr. W. F. Hume: In studying the reasons which have led or may lead to the growing of cotton in Egypt and the Sudan, it is important to consider the origin, the distribution, and the nature of the soils to whose presence such cultivation is due. Their source is to be sought in the highlands of Abyssinia, where vast masses of basaltic lava, once poured out at the surface, break up under the action of denuding agencies. Owing to meteorological changes, described with detailed charts by Captain Lyons in his 'Physiography of the Nile Basin,' the heavy rains which fall in Abyssinia during the early summer have a powerful eroding effect on these weathered materials, which are carried down to the lowlands by the rivers Atbara, the Blue Nile, and their feeders, and thus to the main stream of the Nile. In addition there are others, such as the Gaosh, which, having no outlet, spread their fertilizing mud over the vast plains of the Sudan.

In the Sudan the question of cotton-growing is at present one of increase in quantity, and requires accurate survey and a close study of possible irrigation schemes; it will also be stimulated by the development of a thriving population, and an increase in the lines of communication. Those who have followed the history of the Sudan are aware of the progress already made in each of these directions, the opening of the new line between the Blue and White Nile across the Gezia south of Khartum being one of the most important steps in this direction. Egypt, like the Sudan, is dependent for its fertile soil on the material brought down by the Nile to be spread over the Nile valley and the region of the Delta. The enlargement of the cotton area, owing to the absence of rainfall and the proximity of desert regions, can only be secured by the adoption of elaborate irrigation schemes for increasing the water-supply and securing the wider distribution of the transported sediment. The great advances of the last twenty years have resulted from the adoption of a comprehensive

irrigation policy; but, as in other spheres, reform often brings with it new conditions which require careful attention. Of recent years there has been marked anxiety as to the diminution in quantity of cotton produced in Egypt (a diminution happily not repeated this year), and it has also been realized that if Egypt is to keep its high position it is essential that the quality of its cotton should be maintained. Various causes of danger have been suggested, notably a rise in the subsoil water-table, which in Egypt is at no great depth (in some of the best provinces 4 yards) beneath the surface. This may be either permanent, due to canals, or temporary, connected with the over-watering of the fields. Careful experiments by means of tube-wells* are being carried out in districts where this question is of prime importance under the Geological Survey branch of the Survey Department, and important researches are also being conducted by the Khedivial Agricultural Society and the States Domains authorities. Regarding the Survey Department work, with which I have been more particularly connected, the tube-well investigation was begun in Upper Egypt on the initiative of Captain Lyons, then Director-General of the Survey, and has since been extended into the Delta, where the examination is being continued on a more elaborate scale under his successor, Mr. Dowson. The field-work (in which my colleague Mr. Ferrar is engaged) has for its object to prove the relative influences of canal, watering, drains, river, etc., on the subsoil water movements, and the results are being investigated by a commission, mathematicians, chemists, and geologists being called upon to test in detail the results already obtained.

It must be remembered that the cotton plant has an unusually long root (often over 2 yards in length), and if the water-level be suddenly raised by over-watering, injurious results may ensue. The salt difficulty has also to be considered.† In temperate countries the tendency of the surface waters, largely derived from rainfall, is to carry the salts downward; in Egypt the reverse is the case, evaporation under the warmer climatic conditions bringing the salt to the surface. Such areas of salty soil often form broad borders to the high-level canals. In travelling from Cairo to Alexandria this year, the change in the character of the fields of cotton according to their geographical position struck me forcibly. Near Cairo, where the subsoil water is deep, the cotton was in a flourishing condition, but as Alexandria was approached, the plants were more stunted, and large areas of salty ground separated the cultivated portions. Such facts as these are now subject of earnest, and it is to be hoped, successful study.

The ravages of the cotton-worm, boll-worm, etc., have also been serious in past years, but careful inspection this year has proved successful. Much interest attaches to the Mendelian experiments of Mr. Balls, aiming to secure an early growing cotton which may prove more resistant to the influences unfavourable to its successful development, and to Mr. Willcock's researches as to the life-history of the moths, etc., injurious to cotton plants.

The action of the Egyptian Government indicates the importance it attaches, not only to the increase in the quantity of cotton grown, but also to the retention of its quality; while in the Sudan, from what I know of the spirit animating those who are in official charge of its destinies, every effort will be made to foster its fullest development, both as regards area and character.

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* These are tubes of narrow bore sunk in the soil, the position of the water in them being measured by tape at short intervals of time.

† Lucas, in the Survey Department memoirs, and Hughes, of the Khedivial Agricultural Society, have contributed valuable results in connection with this study.

Mr. WILSON FOX: I think one thing that Mr. Reed's paper must bring to our minds is the necessity of taking stock of the resources of the Empire in respect of cotton-growing land. From a geographical point of view, that course is bound to add considerably to our knowledge, because in regard to any particular district where we think we can grow cotton, we wish to know more about the topography, ethnology and the climate, and all the other characteristics which will make for success in the commercial development of the cotton. Therefore the knowledge we shall acquire by seeking after these districts will help us to fill in the gaps in our maps in such countries as Rhodesia, West Africa, and other parts of the Empire. The British South Africa Company has had some practical experience of the working of the British Cotton Growing Association, and most happy relations with its chairman, Mr. Arthur Hutton, and I feel bound to add my testimony to the work which that association has been doing during the past few years. We, the British South Africa Company, have, I think, approached the subject of cotton growing in the right way. We are not approaching it with a view to benefiting Lancashire particularly; we want to benefit Rhodesia and ourselves in the first place, and I feel sure that this is the right point of view, for, as in other businesses, it is only through the operation of self-interest that you can expect to get the best results. That we have been successful here, as I hope we shall be ultimately in Rhodesia, is proved by the fact that we have got Lancashire to put in pound for pound with ourselves. The "baby" of Rhodesia is at the present time not measured by £3, but by £15,000, and the cotton exported this year has averaged 11½*d.* per pound, which is a very considerable price. There is one point which I think one should always bear in mind in dealing with the possibility of the production of cotton—I mean the point of accessibility. We have one very promising district in Rhodesia; it is on the upper portion of the Zambezi, in the territory of Lewanika, the chief of the Barotse. A few months ago one of our native commissioners was pressing upon Lewanika the advantage which it would be to his subjects if they would grow cotton. Lewanika turned round to him and said, "What are they to do with it? They can't eat it!" I think that remark illustrates the necessity, which is realized by the natives themselves, of giving them open markets. However, fortunately the most promising district in Rhodesia is at the present time amply provided with means of transport. One of the most vivid memories I brought back with me three years ago was a day on the Kafue river, which is a most beautiful stream, and navigable for 200 miles. It is tapped by the main line of the Rhodesian railway, and the experts that have been sent out by the British Cotton Growing Association speak most highly of the prospects of that district. We hope in a few years' time to have from there a very considerable output. I may mention that we are proceeding upon the lines of encouraging both white and native cultivation of cotton, and such important persons as the Duke of Westminster and Lord Wolverton have already established large estates in the vicinity of the Kafue. But we are proceeding cautiously, and here it is that we find the great benefit of having such an organization as the British Cotton Growing Association ready to our hand. I do not for a moment suppose that the object of the Association is to grow itself all the cotton which Lancashire requires; what it does and should do is to provide information and an educational influence. That, in my judgment, is the most valuable work which it has set itself to perform. I should like to thank Mr. Reed very much for the most interesting and suggestive paper to which we have listened this evening.

Mr. REED: I must thank you all most heartily, Mr. President, for the very

kindly and courteous manner in which you have listened to my address, and I desire especially to thank those gentlemen who have joined in the discussion. I may say that there are many points which they have raised with which I am in perfect agreement. The ideas suggested require to be developed and worked out, but it would have been utterly impossible for me (even if I had the ability to deal with those various branches) to give sufficient attention to such questions in one evening and in one paper. There is room, I think, for many papers of a more scientific character than the one I have attempted to prepare, to be written and read, before this subject can be adequately dealt with. I think one speaker rather misunderstood my ploughing scene slide. I merely used that slide as pictorially typical of the work that the white man is doing in Africa, viz. teaching civilization to the black man, and not as suggesting that cotton should be cultivated by white labour. I am quite well aware that cotton growing in Africa or anywhere else must be done by the natives themselves; but such natives must be taught how to do that work in the best way, and that can only come from European example and guidance. With regard to Indian cottons, I may say it is well known that cotton is grown in large quantities already in India, but it has been found, I believe, that the only portion of that country where they have so far been able to satisfactorily grow the long-stapled fibre is in the Scind district. Indian cotton is a short-stapled variety of very little use in Lancashire. When the native growers of India are induced to turn their attention to a different kind of seed, which produces a longer-stapled cotton, they get a much smaller crop, and it will take a long time to persuade the average native cotton grower to give up quantity for quality. This is, however, a very large and involved question.

A SIXTH JOURNEY IN PERSIA.*

By Major SYKES.

We quitted Astrábád, bound for Shahrud and Meshed, in gloomy weather, and it seemed probable that the famous Kuzluk pass might cause us some delay. Having ridden to its foot through the last lovely forest we were to see, we began a steep, winding ascent, during the course of which we were gladdened by the sight of holly bushes full of berries, boughs of which we took home for Christmas. After toiling uphill for nearly two hours we suddenly came upon a ruined caravanserai with a wooden house, and this, to our surprise, was the stage of Kuzluk, situated less than half-way up the pass. The night was fine and not very cold; but the next march was extremely trying for man and beast. The ascent continued for another two hours, and after a total climb of perhaps 7 miles from the foot of the pass, during which we had ascended some 4000 feet, we reached the crest, which is known as the Gardan-i-Aliábád, from a small caravanserai near the summit. The altitude was 7600 feet, and the pass, so far as my experience goes, has the longest ascent of any in Persia. The superb Shah Kuh, which dominates Shahrud, rose grandly to the south, and we descended to a frozen valley across a neck termed "Gardan-i-Jilang-Bilang."

* Continued from p. 19.

Finally, in intense cold, we crossed a second pass termed the "Gardan-i-Wajmanu," at 8600 feet, and descended to Tásh, where again we found quarters in the telegraph office, and enjoyed a well-earned rest. This march worked out at 25 miles, and during it we had crossed the backbone of the great range which runs down from the Pamirs, across the heart of Asia to historical Ararat. Tásh forms part of the Astrábád province and is the summer retreat of the Governor and Russian Consul. It was also the first stage at which, after twenty-one days of unsuitable food for the transport, barley, dried lucerne, and straw were all procurable in abundance. It appears that lucerne does not grow in the Astrábád district.*

From Tásh a downhill march brought us to within sight of Shahrud; but we turned off to the east of the road to visit Bostám, formerly the chief town of the district of Kumis; it has, however, now yielded its position to Shahrud. We anticipated a visit to its ancient buildings with keen interest; but, in Persia, it is uncertain whether the custodians of a shrine will welcome the European or not; however, in this case, possibly because the saint was a Sunni, we were shown everything. On passing through the chains which mark the sanctuary, we first examined the tomb of Amir Azam Khan, brother of Amir Shir Ali, Barakzai, who had died, some forty years ago, on his way to Tehran, where he hoped to secure the support of the then Shah Nasir-u-Din. But the fame of this shrine is due to the fact that in it lie the bones of the great Sufi, *Shaykh* Abu Yazid, more generally known as Bayazid Bistámi, who died in A.H. 260 (874). The *Shaykh* is buried in the open, he having signified his wishes to this effect by means of a dream to the custodian of his shrine when a dome was erected; the tombstone is of a white marble and elaborately carved. His memory is still kept green in India, in proof of which a sowar of the Meshed escort came to me that night in a state of great excitement and begged to be allowed to visit the shrine, as the *Shaykh* was the founder of the sect to which he belonged.

The shaking minaret was next inspected, and two men shook it, with the result that a brick set on edge fell down. It is about 40 feet high, composed of brickwork, and decorated with geometrical patterns, and two belts of Kufic inscription. The shrine with its little court and the minaret were erected by Muhammad Khudabanda, a descendant of Hulagu Khan, at the beginning of the fourteenth century.

The friendly *Shaykh* Ahmad, who claims descent from the Saint, himself took us to see what is termed the Kashána, in which, according to the legend, an "unknown sultan" lies buried. This mosque is a polygonal tower constructed of bricks with each course throwing out a salient angle. Its height was about 40 feet, and its circumference rather more: it is surmounted by a dome from which the tiles have fallen. The term Kashána which signifies a "hall," is somewhat difficult to explain; but Fraser, who

* *Vide* paper by General Beresford Lovett in the *Proceedings of the Royal Geographical Society*, vol. 5, No. 2, for February, 1883.

was allowed to examine the interior, read an inscription, according to which the mosque had been built in A.H. 700 (1301) by order of Sultan Khan Kasan. This is undoubtedly a different form of Ghazan Khan, the correspondent of Edward I. of England, and is the probable explanation of the name "Kashana."

From Bostám to the modern town of Shahrud is about 4 miles, and upon completing the stage we found our camp pitched at some distance from the town, which is infested by the dangerous *Argas Persicus*, the bite of which undoubtedly causes fever. It is curious to learn that this bug is believed on good authority to still exist in Canterbury cathedral, to serve as a memento of mediæval travel! Shahrud is thriving and increasing in importance, as it is the collecting centre for cotton and other exports, not only from the vicinity, but even from distant Kerman and Yezd. The town, however, appears to be dilapidated and ruinous, and its life now centres mainly in a new quarter which has been built outside the Meshed gate.

Shahrud is the halfway stage between Tehran and Meshed, and there was comparative animation as we hastened eastward on our return journey. The first stages were famous as the "Marches of Terror," so graphically described by many travellers; indeed, the numerous low ranges and broken ground formed ideal haunts for Turkoman to lie in wait, of which, even since my journey, they have taken advantage. The caravanserais, notably that at Miándasht, are very fine, containing accommodation for hundreds of wayfarers, and it is difficult to overestimate their value when travelling in the winter. Between Miándasht and Abbásábád we found numerous heaps of slag, when riding off the track, in which connection Fraser mentions the existence of a copper-mine which had been worked as late as the reign of Nadir Sháh. At Abbásábád, the inhabitants are descended from Georgians posted there by the great Sefavi monarch; they not only pay no revenue, but receive allowances from the Persian Government. At night, there was a wedding in the village, and a procession with torches and lamps fetched the bridegroom, the whole party dancing with great vigour to the sound of horns and drums. Later, the same procession fetched the bride, who, covered with a white shawl or *chaddar*, held on to her husband, the whole party dancing as if possessed.

From the stage of Mázinán, we rode 10 miles south-east to visit the ruins of a town termed Badghus, which I have been unable to identify.* Thence we went on to our stage at Mihr and, after changing horses, rode north up the valley to examine the ruins of Pá Kala, distant some 5 miles. This fort is small, and is built on a mound composed of conglomerate; and the only traces visible consisted of a wall of uncoursed stones and fragments of mediæval pottery. In the next valley to the east are said to be the ruins of a town termed Shuru. Mihr is undoubtedly a

* Coins of the fourteenth century of our era and metal ornaments were found there.

centre of the greatest importance to Zoroastrians as it is the site of the third sacred fire, known as *Atur Burzhin Mitro*, or "The Fire of the Labouring Classes." A few miles further east, too, is Rivand, the village which gave the name to Mount Raivant, the general nomenclature for the range on which the fire temple was situated. It is possible that a week spent in examining these ancient sites, which are locally considered to have been built by Gabrs or "infidels," might result in interesting discoveries, as the whole district is connected with the birth of Zoroastrianism, Miándasht, to give a single instance, being the site of the final victory of the Khorasanis (who, under their King Gushtasp, had embraced Zoroaster's tenets) over the hated Turanians.

To resume, a long march of 32 miles brought us to Sabzawar, the only object of interest on the road being a fine minaret, which is all that is left of Khusrugird the former capital. Sabzawar struck me as a rising town, both from the size of its bazaars, and the activity which reigns there. Like Shahrud and, in a lesser degree, Nishapur, the output of cotton is steadily increasing, and as the export trade in cotton, wool, dried fruits, and other commodities now exceeds the imports from Russia, these towns are certainly more prosperous than at any period since the Mongol cataclysm.

As Christmas was very near, we only halted the night, and pressed on to Nishapur, which is referred to in detail in the second part of this paper.

Three stages were all that remained for us to accomplish, and, upon leaving Nishapur, we rode to Kadamgáh, where a shrine was built by Shah Abbas to cover the footprint of the *Imam* Riza. This shrine is surrounded by fine stone pines, and is being repaired by the custodian, who apparently makes a considerable profit from the pious task.

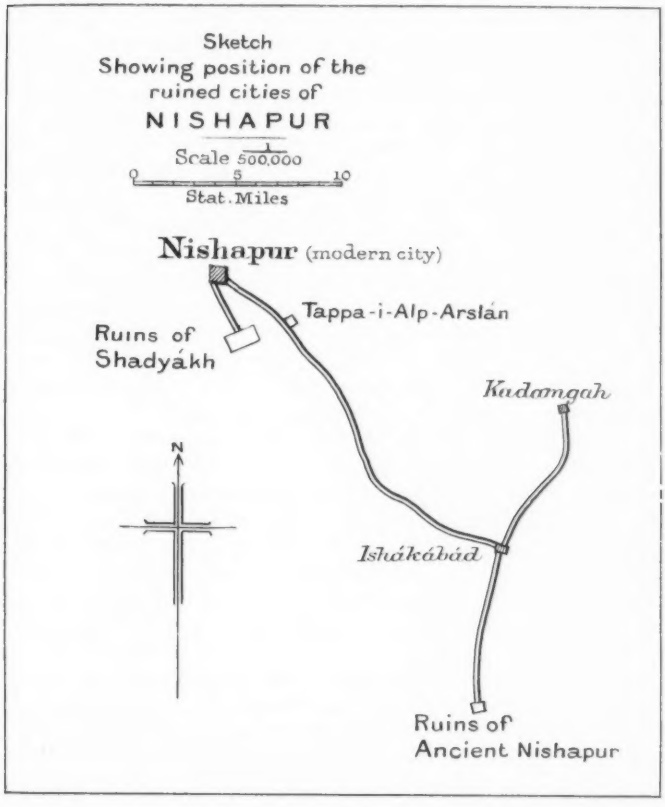
To conclude, the last two stages * lay across snow, and, on December 22, we reached Meshed, and thus concluded a most interesting tour of 880 miles round ancient Parthia.

The objects of the second tour, which I am about to describe, were twofold. In the first place, I had been informed on good Persian authority that the ruins of a city of Nishapur, older than those situated 3 or 4 miles from the modern site lay somewhere to the south-east of the present city. As the existence of an ancient Nishapur has never been discovered by previous travellers, and as the importance of that historical capital was so great, it seemed most desirable to examine this question in the light of this information. My second object was to visit the district of Turshiz, and to examine, among other sites, what were said to be the ruins of the

* A few miles west of Sharifabad, the last stage to Meshed, are situated the ruins of Pawaján; the range, too, bears the same name. It is of interest to note that this is probably the Ojajan of Ruy Gonzalez de Clavijo, where the ambassadors received the messengers and invitation of Shah Rukh. (*Vide* Hakluyt Society, 'Embassy to the Court of Timour,' edited by Sir Clements Markham.)

city of Turshiz, which succumbed to the might of Tamerlane, and has, since that date, lain desolate.

I was fortunate enough to have Mr. Rennie, first Secretary of the Legation, as a fellow-traveller as far as Nishapur, and, leaving Meshed on November 4, 1909, we marched to Jághark. That lovely hill valley was even more beautiful than in the summer, as the autumnal tints were gorgeous with their rich colouring enhanced by the deep blue of the Persian



sky. The pass over the main range was crossed in fine weather, and, from an elevation of 9400 feet, we looked back on to the valley of the Kashaf Rud, and clearly descried the golden dome, which appeared to emit flashes. The descent to the important village of Darrud was particularly trying, and one mule fell down the hillside and was killed.

Darrud is situated at a point where the hills open out, and can boast of some wonderful *chinar* or oriental planes. A few miles below it, we

struck the Meshed-Nishapur postal route at Kadamgáh, which I had visited when returning from Astrabad on the previous year. We crossed the main route, and camped some 8 miles to the south of it, at Ishákábád, as this village was the nearest to the ancient site we hoped to find on the following day.

Upon riding towards our goal, we entered a *chaman*, or meadow, and crossed an almost dry river flowing west, termed the Kal-i-Shur or Salt river. Here we found the ruins of a stone bridge, which fact is of some importance. Passing Janatábád, a hamlet, situated on the southern edge of the *chaman*, we rose very slightly, and traversing a bare, gravelly plain, reached the site at some 7 miles from Ishákábád.

What we saw was a ruined wall which had almost sunk down level with the ground; but which, in the shape of a low bank some 6 feet high, showed clearly enough that it had once enclosed an area of 310 yards from north-east to south-west by 260 yards from north-west to south-east. At the northern angle, and some 60 yards from it, were the ruins of the fort raised on a mound some 20 feet high, on which were the traces of a wall measuring 60 yards square. To the south-west of the city, and a quarter of a mile distant was a second even lower mound, of which only the north-east side, measuring 720 yards, with faint traces of other walls at right angles, was visible, everything else having been reabsorbed into the soil. Fragments of reddish and of blue glazed pottery, broken bricks, a red bead and a solitary coin were all that was found on the site first described. On the second site, nothing was found.

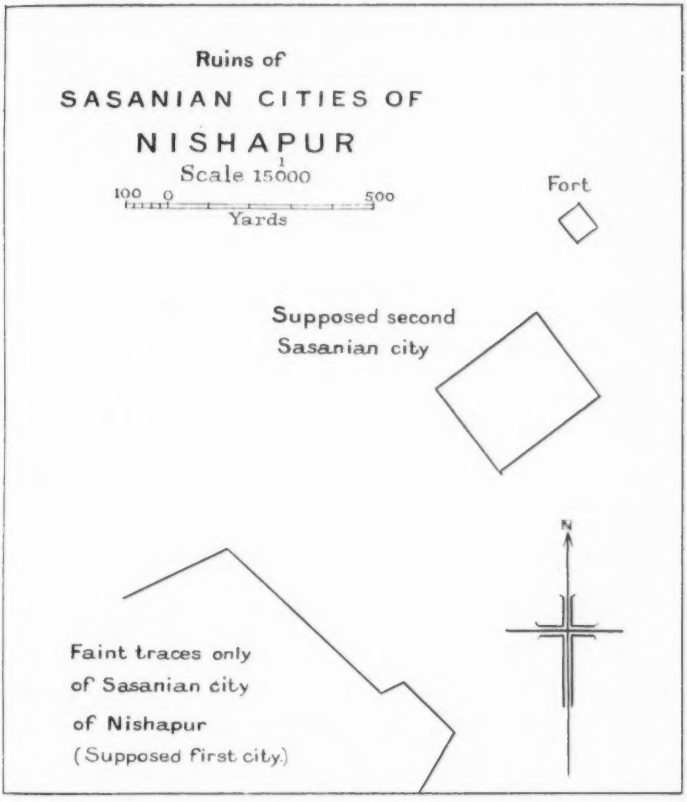
I now propose to turn to what can be gleaned from other sources. Nishapur is undoubtedly derived from the old Persian Niv-Shahpur, signifying "the good deed of Shahpur," and according to the Arab writers, it was founded by Shapur I, son of the founder of the Sasanian dynasty, who held the viceroyalty of Khorásán under his father. After Shapur's death the city, which was badly situated, from the point of view of agriculture, fell into ruins; and was rebuilt about a century later by Shapur II. It is mentioned that Nishapur was small, and of no great importance at that period.

Taking, then, the above facts into consideration, and the fact that the walls of various cities, such as Tus, deserted six or more centuries ago, are still standing, whereas here we simply have the lowest of mounds; taking also the unanimous local opinion on the subject into consideration, I would suggest that it is probable that the ruins we discovered are those of the first and second Sasanian cities of Nishapur.

To resume, a short march brought us to Nishapur, where we were able to examine the mediæval Arab cities, which are situated some 3 or 4 miles to the south-south-east of modern Nishapur.

In the early days of Moslem rule, Nishapur was termed Naysabur, and in the third (ninth) century it became, under the Tahiri dynasty, the capital of Khorásán, which then included Merv, Balkh, and Herat, its eastern limits being the river Oxus. In the fourth (tenth) century it

was one of the great cities of Asia, measuring a league every way. It was also famous for its commerce, cotton and silk, both raw and manufactured, forming its chief exports. It continued to be the capital of the "Great Seljuks," Tughril Beg and Alp Arslan; the memory of the latter is perpetuated by the fort in the older Arab city, termed Tappa-i-Alp Arslan or the "Mound of Alp Arslan."



It was during the zenith of its prosperity that Omar Khayyam lived and died in Nishapur; and his tomb was pointed out in a shrine sacred to Mohamed Mahruk, which was built some four centuries after his death by the great Sefavi monarch. Later on, in the twelfth century, the calamities of Nishapur commenced with an earthquake, followed by massacres inflicted by the Ghazz tribe, when the city was devastated. The surviving inhabitants removed to the neighbouring suburb of Shadyakh,

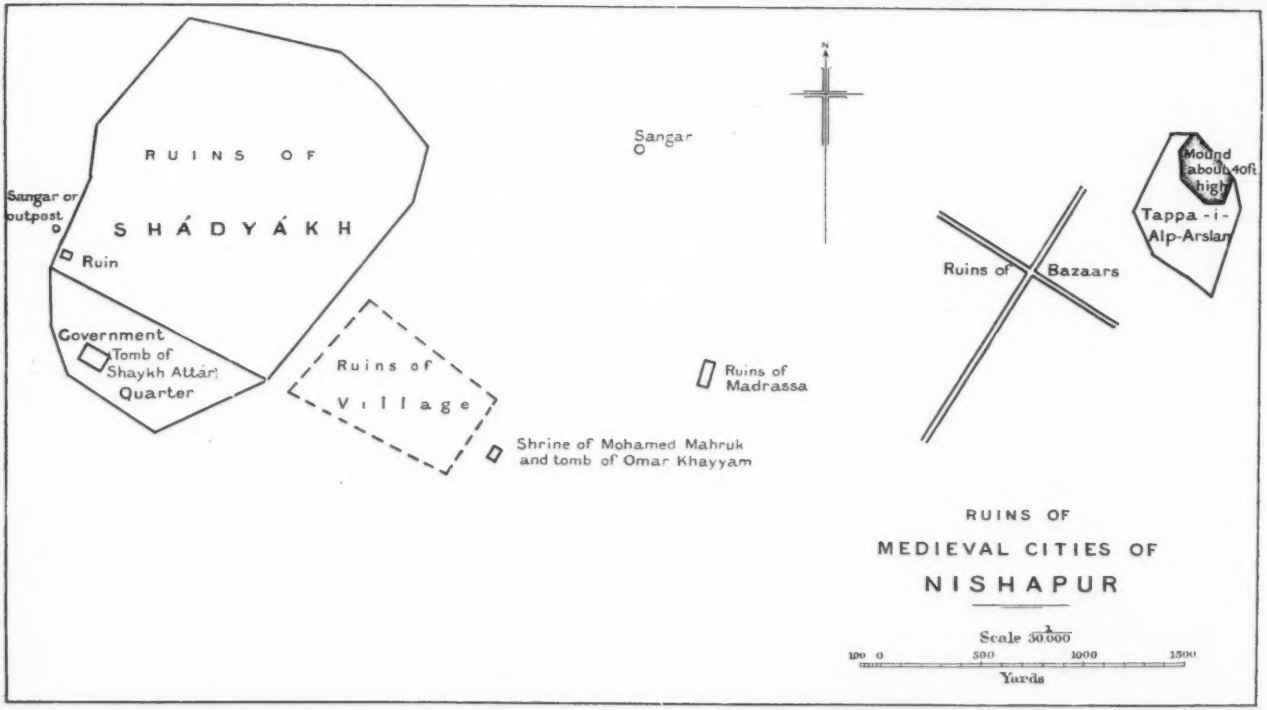
a short distance to the west; and a wall was built round what now became the capital, which is still extant, with an interior wall dividing off the Government quarter. On the west side, and also the east, are the ruins of two *sangars* or outworks. The tomb of *Shaykh* Attar, the great mystic poet, whose didactic poem the *Pand Nama* is, I understand, a text-book in Mohamedan schools in India, lies in the Government quarter of Shádyákh; it has recently been repaired by His Highness the *Nayir-u-Dola*.

The most appalling calamity now befel Shádyákh when, in A.H. 618 (1221), it was stormed and sacked by the Mongols who, according to the Persian historians, drove out the citizens in batches and slaughtered them like sheep, the only men spared being forty skilled artificers who were enslaved. The irrigation channels were dammed up and then let loose upon the devoted city; and the force of the water swept away all the buildings, after which the site was sown with barley, as, indeed, it is to-day.

It is difficult to be sure where the next city of Nishapur, which was described by Ibn Batutah in the eighth (fourteenth) century, stood. Possibly, as the interior of Shádyákh contains no ruins whatever, the site of the older city was again used; and this is rendered probable by the fact that it is possible to trace the lines of an old bazaar, a short distance to the west of the Tappa-i-Alp Arslan; there are also the ruins of a *madressa*, a little further to the west of the ruined bazaar. Nature, however, in the form of earthquakes, vied with the violence of man in destroying this famous city, and now there remain but a few mounds in a cultivated area to mark it; and the site of modern Nishapur is 3 or 4 miles to the north-north-west of Shádyákh.

To summarize, 24 miles to the south-east of modern Nishapur sites of what are, I believe, two Sasanian cities were discovered by us. Between these and the modern city, some 4 miles south-south-east of the latter, lie the ruins of Nishapur, the famous city of mediæval times. In close juxtaposition is Shádyákh, founded as a camp by the Tahiris; but afterwards promoted to be the capital, when, owing to earthquakes, the older site was abandoned. It was Shádyákh which was sacked by the Mongols and literally levelled to the ground. The later city probably occupied a portion of the great city, and the modern city is situated some 4 miles to the north-north-west. To conclude, as this question has never, so far as I am aware, been gone into before, its solution is, I venture to think, of some historical importance.

Leaving Nishapur for the district of Turshiz, the track skirted the ancient city and ran south through a very rich strip of country; and indeed the Baluk-i-Ishkábád, which should not be confused with Ishákábád, is famous for its fertility. Some 11 miles after starting, we crossed the same salt river which we had already struck further up, near Sasanian Nishapur; and, beyond it, stretched a barren salt plain to Sálári, where the water was brackish.


RUINS OF
SHÁDYÁKH
Sangar or outpost
Ruin
Government
Tomb of Shaykh Attar
Quarter
Ruins of
Village
Sangar
Ruins of Madrassa
Shrine of Mohamed Mahruk and tomb of Omar Khayyam
N
Mound about 40ft. high
Tappa-i-Alp-Arslan
Ruins of Bazaars
RUINS OF
MEDIEVAL CITIES OF
NISHAPUR
Scale 1/30,000
100 0 500 1000 1500
Yards

The following day we marched south-south-east to Targhi, situated on another salt stream. From this salt district we moved south-west to Katkan, an important village of 400 houses, situated on the skirt of the range at an elevation of 6200 feet. It is said that, for the last two years the cold has ruined the fruit crops. The inhabitants are Karai, and the village forms part of the Turbat district.

My object in visiting Katkan, apart from the fact that the district was a blank on the map, was to examine a shrine, in which it was alleged that the famous *Nizam-ul-Mulk*, the Vizier of Malik Shah, was buried. Upon entering the village, where we, as being possibly the first Europeans seen by its inhabitants, not unnaturally excited considerable curiosity, we were taken to a partially ruined brick building, consisting of a central arch with two *gushvar* or side chapels, and were informed that the *Nizam-ul-Mulk* was buried in the eastern chapel. The dome of this building showed traces of rich mosaics with florid designs in white, dark blue, and light blue, which unmistakably belonged to the Sefavi period. The interior, too, with remains of tiles, rich stencil and the Yasin chapter of the Koran, moulded in plaster letters, closely resembled the decoration of the shrine of Khoja Rabi near Meshed. In the centre was the tombstone, a monolith of black stone some 5 feet in height, with the inscription perfectly legible. It recorded the name of *Shaykh* Muiz-u-Din, *Nizam-ul-Mulk*, son of *Shaykh* Shahab-u-Din; and the date was A.H. 938 (1532). This proved that the shrine was not, as reputed, the resting-place of the great vizier; and also that it was a monument of the Sefavi period.

From Katkan, we marched north-west for two stages, as there is no pass across the Kuh-i-Surkh range; and the second day we camped opposite the Dahana-i-Sahn, which is on the direct Nishapur-Turshiz route. A long march took us across this unexplored range, and we camped at Ráush (more correctly Ribush), the capital of the district of Kuh-i-Surkh. This upland valley—the elevation of Ráush is 5300 feet—is well watered, and a stream runs down to the plain of Turshiz. An ancient dam is said to be in existence a few miles below, which only requires a small expenditure to double the water-supply.

A particularly trying march across yet another range brought us to Turshiz (3400 feet), where we halted for a day: and I now propose to give a short sketch of the very interesting district which I had entered and which I examined in some detail. The earliest mention of Turshiz is in connection with the legend, to which some historical value may be assigned, that it was the scene of the activities of Zoroaster; this will be dealt with later on.

In mediæval times, Turshiz was known as Pusht, or Busht-al-Arab, and formed the north-west district of the province of Kuhistan, of which the two chief towns were Turshiz (now Firuzabad) and Kundar, which is still an important centre. In the sixth (twelfth) century, the district was seized by the Ismailis, better known to us as the Assassins; but, a century later,

Hulagu Khan destroyed their power. Yet another century passed when Tamerlane appeared and sacked the ancient capital which has, since that date, lain desolate.

The present town was founded by Abdul Ali Khan, governor of Herat under Nadir Shah and completed by his son Mustafa Kuli Khan, a contemporary and rival of Ishak Khan of Turbat. It is walled and contains a population of 7000 to 8000 inhabitants; but suffered considerably during the earthquake of 1903, which fortunately affected only a small area. The town is now known as Turshiz. Adjoining it, is a village now termed Sultania with gardens and a ruined shrine to *Sayyid* Hamza Riza, brother of the *Imam* Riza, which can boast of some fine firs and cypresses. In the latest map, Turshiz does not appear as the name of a town; but this is no longer correct; and Sultanabad, which is shown, is now termed Sultania.

Upon resuming the tour, we rode west across a level and fertile plain to Sar-i-Hauzak. There we quitted the main track and turned north some 4 miles to the foot of the black inhospitable-looking range, up which runs a steep ravine. This was closed by two walls of uncoursed stones, terminating in towers. Shortly above this defence, the valley bifurcates and the track winds up the western side, which, some distance up, was also built across by a similar wall. After a steep climb, passing the mouth of what was said to be a subterranean tunnel running to Nishapur, the main fort erected on two terraces of artificially levelled ground between the two valleys, was reached. The ground was held up by walls of uncoursed stones; and there were thousands of broken bricks and fragments of blue and yellow pottery lying about. The bricks of a reddish colour were 10 by 10 by 3 inches, which is unusually large. A track led down to the spring at the top of the eastern valley; on the way we saw a long narrow groove cut in the rock. There were numerous other towers on the hills and, generally speaking, the position was most carefully fortified. This ancient site is known as Kala Atish Gáh, or "Firetemple Fort;" and legend assigns it to the Zoroastrians, whose connection with Turshiz is very intimate as, after the conquest of Persia by the Arabs, the faithful remnant lived in Kuhistan, and it was from this province that the ancestors of the Parsis of India emigrated to Surat, *viâ* Hormuz.

After examining this ancient site we returned to the main track, passing on our way some nomad tents inhabited by Tahiri Arabs. These men are the descendants of the Tahiri dynasty which ruled Khorásán in the third (ninth) century, and, as mentioned with reference to Nishapur, made that city the capital of Khorásán. I have been informed on good authority that old *Kanat* pipes are frequently found stamped with their name.

Khalilábád, 12 miles from Turshiz, is a small but very prosperous town. Beyond it lay numerous villages, and the river which flows down from Kuh-i-Surkh was crossed at Sartaráz or, "The top of the division," where the water is divided into six channels.

The western portion of Turshiz which we now entered, is termed Páin

Viláyat or Netherland; and the first village of Kishmar, at 26 miles, is built round what is termed the Minar-i-Kishmar. This striking edifice resembles the Kashana at Bostám, the Gunbad-i-Kábus and the Mil-i-Radkán. Built on uncoursed stone foundations, some feet above the ground are 12 brick panels, each 12 feet square, the building being a duodecagon outside. Above are salient angles, and half columns of brick. The building is surrounded by a conical top. Blue tiles are let in at intervals on the outside wall, which is covered with patterns.

The interior is octagonal, with a diameter of 22 feet, the thickness of the walls being 12 feet. The niches are decorated with rich plaster work in two stories. The total height may be 100 feet. The building has a staircase, and it probably served as a tomb; but of this there are no remains. Fragments of tiles were procured which date from about the thirteenth century, and as we know from an inscription that the Gunbad-i-Kábus was built in A.D. 997, it is reasonable to assign the Kishmar edifice to about the same period.

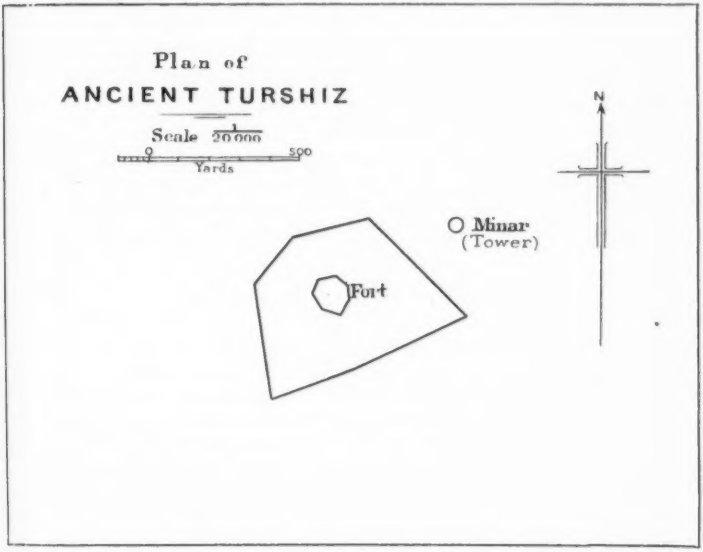
But the historical interest of Kishmar is far more ancient, as it was, according to the unanimous opinion of ancient Persia, the spot where Zoroaster, to commemorate the conversion of King Vishtaspa (the Gushtasp of the *Shah Nama*) to the Magian faith, planted a cypress tree. The story runs that this tree, which grew to a supernatural size, remained for century after century as a witness to Zoroaster; but in A.H. 247 (861), the Caliph Mutawakkil had it felled and transported across Persia to the Tigris to be used in the construction of his palace at Samarra. Large sums of money were offered in vain by the heart-broken Zoroastrians to the Tahiri governors. However, they had their revenge, as the historians mention that, when the logs reached their destination, Mutawakkil was dead, murdered by his son.

A short march to the south-west lay the ruins of the ancient city of Turshiz, which do not appear to have been examined by any previous traveller. As mentioned above, it was the capital of the district and suffered from the onslaught of Hulagu Khan in the seventh (thirteenth) century. It had, however, recovered and, owing to its deep ditch and high walls was believed to be impregnable when besieged by Tamerlane. That great master of war, however, tapped the water in the ditch by using a body of *Kanat* diggers; and he then drove a mine under the walls which fell down. The garrison surrounded, was spared and re-enlisted in the Tartar army, to serve in Turkestan.

To-day the small village of Firuzábád (3000 feet) has sprung up to the west of the ruins, and between it and the walled area is the *minar* or column, which is round, with a circumference of 70 feet. The height is, perhaps, about the same. There is a herring-bone pattern worked in the bricks and a belt of Kufic inscription about 20 feet above the ground. This tower, which could be ascended, was, like others of its class, probably constructed to serve as a watch tower.

The fort rises some 30 to 40 feet above the level plain, and the city evidently spread far and wide outside the walls, in which connection there is a legend to the effect that a flock of sheep could be driven over roofs the whole way to Kishmar.

A good deal of pottery was brought for sale, which shows how very little shapes have changed in Persia; but of greater interest was a perfect specimen of what is, I believe, old Persian glass: a Chinese snuff-bottle was also brought for sale. The district had recently suffered from a raid of Fars nomads, said to be Kashgai, who had carried off 2000 camels and other property. It is more than a generation since such raids have



been pushed farther north than the Tabas district; and it is wonderful what enormous distances these light horsemen traverse, as the Kashgai country is beyond Shiraz!

At Firuzábád, we were in the western edge of the district of Turshiz. I was, however, informed that there were important ruins in the district of Doruna to the west, which are termed Shahr-i-Sufid, or "White City;" but I was unable to extend my tour so far west. In this connection, it is to be recollected that there was the famous "White Forest" of Kuhistan.

From these very interesting relics of a historical part, we travelled east to Kundur, with its ruined fort of Bárkala, which, at one period, was the rival of Turshiz city, and which is still an important centre, lying in a very rich district. Indeed, I was much struck by the fertility of Turshiz,

which produces a great variety of crops, and where they say that a plough only lies idle for forty days. This is, in part, due to its mean elevation, barely exceeding 3000 feet, and its proximity to the still lower levels of the Lut. At Meshed, for instance, figs and pomegranates do not grow, whereas in this district, they are especially fine.

From Kundar, we passed to the south of the modern capital, and hearing of extensive ruins on the edge of the low-lying district of Mahavalát, we crossed a low range and camped at Himatabad, where some of the famous small, dark green melons with pink inside, were brought for sale; and I must own that their flavour disappointed me. East of Himatábád were ruins also known as Shahr-i-Sufid; and among the low hills are traces of Kala Shir, said to be a corruption of Kala Hajir, or "the fort of Hajir," who was a noted *pahlawan* or champion in the days of Rustam. He was in charge of the Diz-i-Sufid or "White Fort;" and fought with Sohrab, but was vanquished and captured by that heroic youth. All these ruins are said to date back to the Zoroastrian period.

We now swung north to Azghand, an important village with some very fine cypress trees. It was the private property of Ishák Khan Karai, who nearly a century ago, was besieged in it for a whole year by Hassan Vali *Mirza*, son of Fath Ali Shah. As both sides became tired of the siege, peace was made, and Ishak Khan gave his daughter to the prince, from whom my host at Turshiz is descended and Asghand still remains in his family. A long stage brought us to Turbat-i-Heideri, and so back to Meshed, after successfully accomplishing the objects I had in view.

The PRESIDENT (after the paper): The extremely interesting lecture we have just listened to proves how much there is yet to be learnt with regard to the geography, both ancient and modern, of Persia, especially perhaps of the ancient geography, which must be based on archæological researches. I am quite sure that Major Sykes will continue his valuable researches, and that we may look forward to other lectures from him, dealing with other interesting parts of Persia. Major Sykes has had great obstacles to surmount, for it is always extremely difficult in a distant land for a foreigner to learn about the habits and customs of the people; in fact, it sometimes has occurred to me that we do not sufficiently study the accounts given by foreigners of their own countries. In all seriousness, this is a branch of study which geographers might with advantage look to more carefully than they have in the past. In connection with this, I perhaps may remark that Major Sykes, together with an Indian colleague, has just published a most interesting book called 'The Glory of the Shia World.' On the title-page it is described as the translation of a Persian manuscript; it appears, in fact, to be the account, in autobiographical form, of the life of one Nurulla Khan, obviously a man of some standing, for we hear that he is the grandson of a person described in a note as the original of Haji Baba. Now, I confess I do not quite know the full meaning of that note, and I will also confess that in reading this work some suspicions crossed my mind which I could not possibly allude to in the presence of Major Sykes. If any of those here present had had an ancestor who had dined in the presence of Defoe, would they have expected him to have asked him whether Robinson

Crusoe was a real individual? Such a question would surely have been impertinent, and I am sure you will think I was discreet, when I had the pleasure of dining with Major Sykes just now, in not asking him any impertinent questions about Nurulla Khan. When you come to read his amusing work, you must endeavour to stifle any doubts that may arise, and whatever else may be said of Nurulla Khan, he is certainly a very amusing personage.

General Beresford Lovett: I deem myself most fortunate in having been able, during one of my erratic visits to England, to be present at this meeting to hear the very able paper read to us by Major Sykes, to have had the pleasure of making his acquaintance, and to congratulate him on his many achievements towards a better knowledge of the geography of Persia and a better insight into the workings of the Persian mind. I fancy that by this time the "nufus-i-batani" of the average Persian is an open book to him.

Referring to his journey from Astrabad *viâ* Bostan to Shahrud, I know that route well, although it is now about twenty-eight years ago since I made a plane-table survey of that and collateral routes, and reported on their military importance to the late Sir Charles Macgregor, then Quartermaster-General in India, when I was H.M. Consul at Astrabad.

I had also the honour to read a paper before this Society in January, 1882, explanatory of my journey from Astrabad to Shahrud and back to Astrabad *viâ* Bostan and Charbagh, inclusive of an ascent of the great Shahwar mountain. This journey was in July, and I fancy Major Sykes's journey was in November. I remember remarking on the number of streams crossed on the southern aspect of the great chain that divides the Caspian basin from Irak, as well as the numerous waterfalls. This was long anterior to the time when I began to take an interest in hydro-electric developments. So I will ask our lecturer whether he remembers crossing any considerable streams on his way across the Shah Kuh range, because that would go towards showing the permanence of the discharge and consequent possibility of utilizing the water-power to advantage. I may be permitted to express my regret that, since I had the honour to address this Society, I realize now how sadly diminished in numbers is the band of Persian explorers with whom in former years I was associated. I miss Sir John Champain and Sir Oliver St. John, Sir Frederick Goldsmid, Sir Robert Murdock-Smith, and, lastly and recently, Sir Charles Euan Smith. All of these explorers contributed their quota to a better knowledge of Persian geography. In this connection, and with reference to my map of the Elburz between Tehran and Astrabad and between Astrabad and Shahrud, I should like to ask whether this part of Persia has yet been surveyed in the sense that survey is regarded by the Survey of India? Then Major Sykes, in his paper, writes about Hyrcanian tigers. There is a specimen of one at the Natural History Museum. A few Sundays ago I went to have a look at my victim, and found him looking quite cheerful, in spite of confinement in a glass case for twenty-eight years.

Sir Mortimer Durand: I have known Major Sykes a long time now, about twenty years, and all that I saw of him when we were in Persia together led me to feel the deepest confidence in his statements of fact. I have never met any man who studied Persian questions with greater care or a more thorough determination to get all his facts perfectly accurate. That is one of the best possible qualifications for an explorer, and there is probably no authority on the country now equal to his.

Mr. D. G. Hogarth: I am afraid I have nothing of much interest to say. I am very grateful that Major Sykes's zeal should have taken him, with his great

knowledge and exceptional opportunities, into this out-of-the-way part of Persia, and that he should devote his attention to the problems of ancient geography. He has not dealt very fully with these problems in speaking to-night, but they are more fully treated in his paper. It is very difficult to get much further with them, and although he has spoken modestly about his achievement, I fancy he has taken us as far as we are likely to get for a good many years to come. There is almost no material to go upon. The eastern marches of Alexander are beset with difficulties. Some years ago I studied these difficulties; I will not say I solved them. The difficulty is to know where this great army, led by Alexander the Great, was at any moment between distant fixed points; it is usually impossible to say, if there are two routes, that he took one more than the other. I do not myself exactly know why Major Sykes says he must have gone up the Gurgan valley rather than have passed under the south of the Elburz range. Topography becomes particularly difficult when we have to deal with an event like the capture and death of Darius, although a good deal is known about it. We are told that Alexander caught Darius in six days after leaving Rhages, which is near Teheran. These were six days of the fiercest possible pursuit, and the stages may have been 30, 40, or 50 miles long. If they are 30 they bring Alexander to about Damghan; if more, to Shahrud or beyond. In Major Sykes's paper, he has drawn an argument on this matter from the silence of the historians of Alexander, about which I should like to say one word. Hekatompylos, the capital of Parthia, has been placed at Damghan. Major Sykes says he thinks it impossible that it should have been there, because in the narratives of the pursuit and capture of Darius no mention is made of the fact that he met his death near Hekatompylos. Our best authority for Alexander was writing as long after the events as we are after the last of the Crusades, and it is by no means certain that he would have had the curiosity to mention Hekatompylos. And there is just one little fact which is mentioned in the story. The waggon in which Darius was, it is said, was drawn aside to a little spring, and there the great conqueror came up with the man he was pursuing. That is to say, the event seems to have happened right out in the open upon the caravan road, and this fact alone would explain the absence of any mention of Hekatompylos. I do not dispute Major Sykes's own identification of that city further to the north; the only thing I do feel a little doubt about is his restriction of Parthia to the rich region north of the Elburz range.

Dr. STEIN: It is an unexpected honour for me to be called upon to say a few words here, inasmuch as I have never had the good fortune of travelling in Persia. But as my earliest Orientalist studies were concerned with the ancient history and creed of that country, I cannot resist the temptation of adding my tribute of appreciation as to the extreme value of the services which Major Sykes has been rendering for many years past to the geography of Persia. He has made himself into a living gazetteer, I may say, of middle Persia and the north of Persia now, and has by his labours worthily continued those splendid traditions of research which are connected with some of the most distinguished early political representatives of this country in Persia. There may be many yet here who remember how Sir Henry Rawlinson, in the very beginning of the serious study of ancient Persia, served the interests of science quite as thoroughly and zealously as he served the political interests of this country and India.

What I wanted to say in regard to archæological matters, I am rather glad Mr. Hogarth's remarks have taken out of my mouth. The difficulty about the definite identification of particular points on Alexander's marches is much increased by the fact that modern local tradition in such matters does not rest upon a

recollection of the real story of Alexander, but is mainly due to familiarity with what historical students call the romance of Alexander. I should think that for the inhabitants of those parts of Persia the real events must have faded very soon into oblivion, considering what a succession of inroads and conquests they were exposed to. I am gratified to know that there are sites which will repay thorough and systematic archæological exploration in future. In the mean time I may express the hope that the line of that ancient wall to which Major Sykes has called attention will be surveyed, even were it merely on the surface. I believe that by observing actual topographical features along it, it will not be too difficult, in the light of the facts gathered along other ancient walls in the West and East, to determine a rather important point. Was it really a genuine defensive border wall, or was it what most Roman walls were originally—a line of fortified posts intended to facilitate the holding of an important strategical route, needed for the better control of some outlying base? However this may be, the defence was intended against those incursions from the great Turanian plains from which Persia has suffered so much throughout all ages. When we hear Major Sykes telling us about the pleasant little raids which are being exchanged on that old border between Iran and Turan, I realize that the historical student has still an opportunity here to study, it is true on a small scale, those interesting problems with which Persia has had only too much to do since ancient times. It remains for me only to express my great pleasure in having seen these excellent slides which bring before us such a distinct impression of the country, and also my thorough appreciation of the great service which Major Sykes has rendered to the cause of the historical geography of Persia.

Major SYKES: I thank you very much for listening to the lecture, and I only regret that I was not able to give it perhaps more lucidly, but the actual paper that has been written can be referred to. There is one point asked by General Lovett, which was whether there has been any better survey of the Elburr done than that which he did, and my reply is, so far as I am aware, his still holds the field.

EXPLORATION IN NORTH-WEST MONGOLIA.

By DOUGLAS CARRUTHERS.

IN my last short report, written from Cha-kul, on the upper Yenisei, I gave in brief the extent of our work in those regions. Now that the expedition has reached its winter quarters at Kulja, I am sending a more detailed account of its course both in those regions and through Mongolia and Dzungaria.

The party, consisting of Mr. M. P. Price, Mr. J. H. Miller, and myself, started in May, 1910, from the Siberian lowlands in the neighbourhood of Minnusinsk, and passed over the Syansk ranges into the secluded basin formed by these mountains, together with the Tannu-ola range, and drained by the numerous headwaters of the Yenisei river. Owing to the late spring, however, we were unable to start travelling until the first week in June, for the snow lies deep in the forests until a late date.

The whole of the Syansk region between the Yenisei and Lake Baikal is covered with the most impenetrable type of virgin forest, called by the

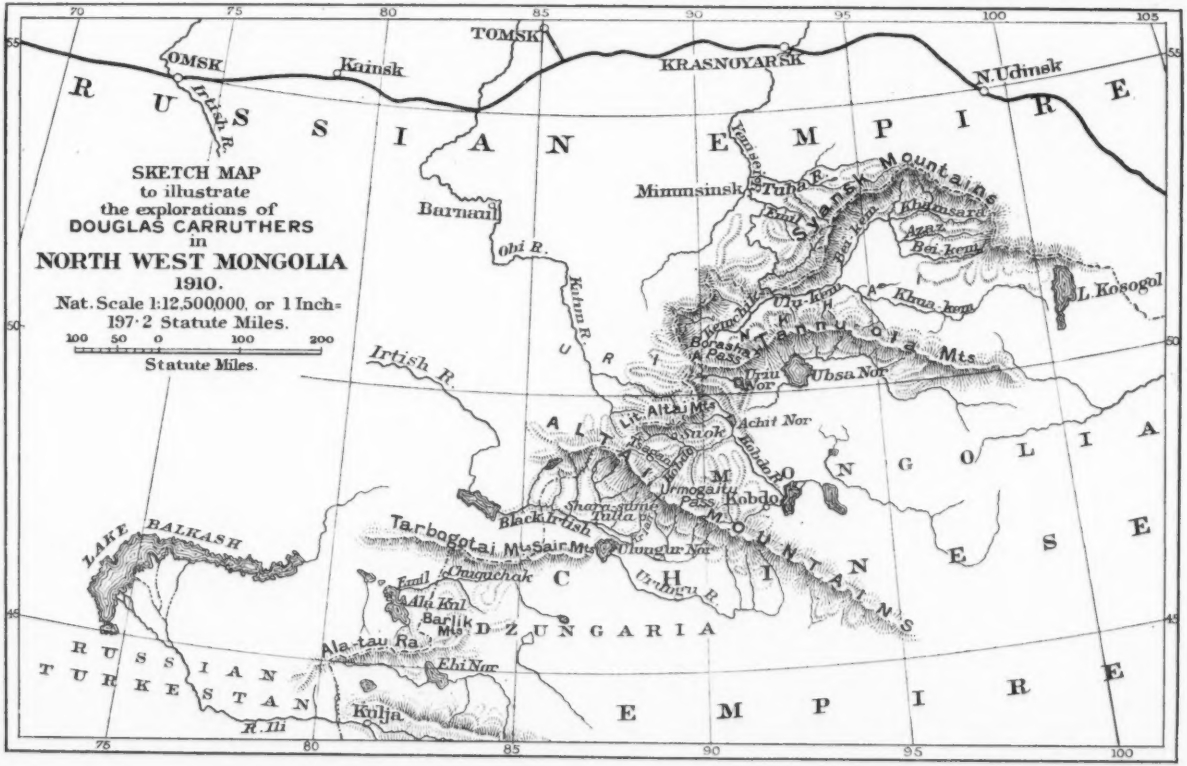
Russians "taiga." This, no doubt, has been the hindrance and barrier that has stood in the way of previous explorers, and accounts for the poorness of the existing maps, the isolation of that country, and the seclusion of the interesting nomad-tribes which inhabit the more remote valleys of the upper Yenisei basin. The management of a heavy caravan of twenty-four horses through such a dense and trackless forest region was trying work, and progress was very slow. Eight miles a day was the average speed at the outset.

The route which followed the Emil (Amil) tributary of the Tuba river (right affluent of the Yenisei) and over the Syansk divide by a low pass of 4524 feet, led on to the Sisti-kem tributary of the Bei-kem, the principal source of the Yenisei. From here a *détour* was made into the unknown country towards the north-east. The Chapsa tributary was explored up to its source, and the Syansk divide was again crossed, and was found to reach an altitude of 4750 feet, with isolated groups of highlands reaching up to 7000 feet. The Mongolian side of this divide is a plateau, whilst the northern declivities drop quickly to the low Siberian plains. The Azaz and Chebush (Chebash) rivers were then followed down to their junction with the Khamsara and Bei-kem, and the densely forested region between this river and the Khua-kem was in some measure explored.

Perhaps the most interesting material collected in this region were the observations on the indigenous tribes. The whole of the upper Yenisei basin we found to be sparsely inhabited by tribes of Uriankhai, a race of Finno-Tartar stock of peculiarly small stature. A section of this race are "dwellers in the taiga," or reindeer-keepers, whilst the remainder live in the more open, park-like country of larch groves and pasture-land. The former we found to be most interesting people, living isolated, lonely lives in the secluded valleys. Their lives are given up to hunting and herding their domesticated reindeer. Mr. J. H. Miller, who investigated the occurrence and conditions of the reindeer in these regions, thus describes them.

"Few people are aware of the existence of reindeer within the boundaries of the Chinese Empire, yet they are to be found there both in a domesticated and wild state.

"On the tributaries of the Bei-kem, upper waters of the Yenisei, Uriankhai were met with who rely almost entirely on their herds of domesticated reindeer for their existence. These reindeer-keepers are only to be found in small isolated encampments, tucked away in remote valleys and amongst the dense 'taiga.' On the Chapsa tributary of the Sisti-kem, at an encampment of twenty-three birch-bark 'wigwams,' possessing a herd of several hundred beasts, there was ample opportunity for studying their habits. The reindeer are used both as baggage and riding animals, the tips of their horns being sawn off to facilitate their passage along the narrow forest paths. Their skins are used for making


SKETCH MAP
to illustrate
the explorations of
DOUGLAS CARRUTHERS
in
NORTH WEST MONGOLIA
1910.
Nat. Scale 1:12,500,000, or 1 Inch=
197·2 Statute Miles.
100 50 0 100 200
Statute Miles.
RUSSIAN EMPIRE
TOMSK
OMSK
Kainsk
KRASNOYARSK
N.Udinsk
Irtish R.
Barnaul
Minnusinsk
Tuba R.
Sayansk Mountains
Khamsara
Azas
Hei-kem
L. Kosogol
Yenisei R.
Obi R.
Katun R.
Irtish R.
Borasha Pass
Ubsa Nor
Achit Nor
Lit. Altai Mts
ALTAI MTS
Suok
Kobdo R.
Urmogaitu Pass
Kobdo
MONGOLIA
Shara-sume
Tulla
Black Irtish
Tarbogotai Mts
Sair Mts
Ulungur Nor
Urungu R.
MONGOLIAN MOUNTAINS
LAKE BALKASH
Emil
Omgachak
Ala Kul
Barlik Mts
DZUNGARIA
Ala-tau Ra
Ebi Nor
RUSSIAN TURKESTAN
R. Ili
Kulja
EMPIRE

clothing, saddles, and various other necessities, whilst their meat and milk form their chief items of diet. As a proof of what a small market value they possess, I had the greatest difficulty in purchasing one, as a zoological specimen. There were two distinct breeds in this one encampment. In their winter coat one is almost pure white, while the other is of a general dark brown colour. They are said, moreover, never to interbreed.

"On the headwaters of the Chapsa river, where the bare tops of the Syansk divide rise above the almost impenetrable forest, the existence of wild reindeer was proved, shed antlers being picked up and one wild specimen being seen. This animal was almost pure white, with short and massive horns. During the summer months they are exceedingly hard to find, living as they do on the upper edge of the timber, amongst cedar, abies, and rhododendron scrub. In the winter they go up on to the open hilltops which are blown clear of snow, and subsist chiefly on an abundant growth of reindeer moss.

"The distribution of these reindeer extends from the upper Sistikem in the west along the Syansk 'divide' to the neighbourhood of Lake Kosogol. It will be of the greatest interest to prove if these reindeer differ in any way from those of Northern Siberia, and whether the customs of the natives with regard to them are dissimilar to those of the northern tribes. It would appear that the Syansk reindeer might be compared to the woodland caribou of North America, whilst those of Northern Siberia take the place of the Barren Ground caribou."

Superstition was rife amongst the inhabitants of this lone and somewhat melancholy region, where every mountain and such objects of nature as trees and lakes are considered deities. Shamanism is practised under a guise of Buddhism.

The western half of the basin was found to be very different to the upper or eastern half. Here were dry steppes with a Mongolian flora, and the natives lived in felt tents ("yurts") instead of "wigwams." The Kemchik region (as, indeed, the steppe country of the Ulu-kem and Minnusinsk) presented many signs of an ancient civilization. Immense burial mounds stood in groups on the plains, those in the Chulim district (north-west of Minnusinsk) being surrounded by upright stone slabs. Carved stone images set upright in the ground, waist-deep, was another peculiarity. In the lower Ulu-kem valley were the still well-preserved traces of a great highway, running with Roman-like straightness and with well-mettled surface. In the forest regions no ancient remains were found.

From Cha-kul on the Ulu-kem our route led up the Chedan tributary of the Kemchik. This was an important and well-populated valley, on the high-road between Mongolia proper and the Siberian towns on the Yenisei. It possessed a large Buddhist Kurin, and was the residence of the hereditary noion, or chief, of this section of the Uriankhai. The

expedition then crossed the Tannu-ola mountains by the Borasha pass to the north-west of Ubsa-nor, and passing along the southern fort of the range, explored the Saklia river up to its source. The Tannu-ola or Snowy mountains presented an even and rather featureless divide, rising to an altitude of 9000 feet. The Saklia range, on the other hand, was an extremely rough and serrated ridge of 11,000 to 12,000 feet. In Mongolia proper the expedition was very well treated by the hereditary khan of the Turbet tribe. Transport and men were supplied, and every possible help was given. The head-quarters of this tribe was situated in a remarkable group of mountains named Turgun and Kundelun, and situated 49° 40′ N., 91° 20′ E.

A considerable amount of survey work was done here, and the altitudes of the peaks determined by hypsometer and clinometer. The ridges were very serrated, and some peaks, of remarkable beauty, rose to an altitude of 13,500 feet. In mid-August we found extensive snow-fields, and thick ice-caps covered some of the peaks. Many glaciers of from 2 to 3 miles in length were found, all of which were in a state of retreat. Altai fauna appeared here, *Ovis ammon* and the Altai snow-cock being found. This was also found to be the northern range of the yak, for the Turbet tribe owned large herds.

In the month of August, the lakes of Uriu-Nor and Achit-Nor were visited, the former of which Mr. Price found to show old strands at a height of 20 feet above the present level, and lagoons in various stages of desiccation between these strands. The absence of nomads was also remarkable, since an abundance of old burial-grounds show a once numerous population. The itinerary of the expedition then led by way of Suok, a Chinese guard-post under the Little Altai, to the Tarkhati and Tsagan-gol valleys. The Great Altai was crossed by the Urmogaitu pass and the route followed the Kran valley to the Chinese settlement of Shara-Sume, or Tulta.

The "Great" Altai, by the way, does not deserve its title. The term "Great" ought rather to be applied to the fine snow masses at the head-waters of the Tsagan-gol tributaries of the Kobdo river, and of the Kanas tributaries of the Siberian Katun river. The Chinese Altai does not appear to rise above 11,000 feet, but the passes were becoming difficult on account of snow-drifts in mid-September. Shara-Sume, the only settlement and cultivated area which we encountered between the Yenisei and Chuguchak, showed the progress and advance of the Chinese in this remote corner of their Empire. Considerable areas were under cultivation, and a small bazaar had sprung into existence. The region between here and Chuguchak was somewhat destitute of life. Our route led across the upper Black Irtish, north of Ulungur lake and across the eastern Sair mountains to the Emil valley and Chuguchak. Here the winter began to threaten us, and we hurried on after a two weeks' delay, to Kulja. During this stage of the journey we encountered that remark-

able physical feature the "Dzungarian gate," on which Mr. Price gives a brief summary of his observations.

"Leaving Chuguchak, a Chinese town on the Russian frontier in the low plains south of the Tarbogatai mountains, and heading along a little-frequented road to Kulja, the traveller passes through the 'Dzungarian Gate.' The Chuguchak plains, at an average height of from 700 feet to 1500 feet, which merge into the great steppes of Ala-Kul and Russian Turkestan, are bounded on the south by the Ala-tan and Barlik mountains, which rise to a height of from 9000 to 10,000 feet. Between these great mountain masses is the gorge or depression by means of which the above-mentioned plains are connected with the deserts north of the main Tian-Shan range. At a distance it looks as if the Barlik and Ala-tan were one and the same mountain mass. On approaching the "Gap," that impression still remains, although it appears that some very ancient earth-movement has caused a great rift here, which has subsequently been carried out by the agent of denudation.

"If the waters that remain of the ancient Asiatic Mediterranean (Balkash, Ala-Kul, Ebi-Nor, etc.) were to rise to a little over 1000 feet, they would flow right through the 'Gap,' flooding the plains to the north and south. This must actually have happened in the recent Quaternary period and also in Tertiary times, when probably the sea was higher still. Deep deposits of fine mud, now carved out by streams into rolling downs, are to be seen on the north side of the Barlik mountains. These deposits, containing marine shells, which will probably turn out to be Quaternary, rise to an altitude of a little over 3000 feet. Near the Barlik range there is abundant evidence of marine glaciation, and the *débris* of icebergs in a frozen sea. On nearing the 'Gap' the mud deposits begin to contain seams of pebbles, false bedded, showing that the currents and tides must have been strong.

"One can picture the 'Dzungarian Gate' in the Ice Age; a narrow strait through which the Arctic-Aralo-Caspian sea ebbed and flowed into the seas of Central Asia, scoured by icebergs descending from ancient glaciers on the Ala-tan and Barlik mountains, and forested perhaps down to the water's edge; not unlike the Straits of Belle Isle at the present day. Now a change has been wrought; earth-movement has drained the sea. But away to the north there still remains the desert lake of Ala-Kul, and to the south a similar lake Ebi-Nor, pools left in the desert, all that remains of the great icy sea. The alluvial plains, once its bed, are now covered by desert grasses, whilst the forest now only clings to the shaded slopes and gullies of the mountains. A wind of terrible violence, rising sometimes to such a force that nothing can stand against it, races through the 'Gap,' the concentrated force of all the desert-winds, pent up, as it were, in the neck of a bottle.

"The Barlik was once, therefore, geographically cut off from the Ala-tau, the former having been an inland in the Quaternary sea.

Geologically it appears to be a part of it. Botanically it contains *Pinus shrinkiana*, or the Tian-Shan spruce, the characteristic conifer of Turkestan; whilst zoologically it was observed that the northern foothills formed the northern limit of the Chukor partridge (*Caccabis chucar*). The real dividing-line, therefore, between Central and Northern Asiatic types, lies somewhere between the Barlik and Sair mountains, and not, as might be expected, in the rift-like depression called the Dzungarian Gate. The Sair mountains are the eastern continuation of the Tarbogatai, and although they were not explored, it was noticed that they formed the southern limit of the Siberian larch. Between these ranges—the Barlik and the Sair, there are other mountain groups which must have formed a chain of islands in a wide strait connecting the northern sea with the seas of Central Asia; and the Dzungarian Gap was merely a strait between one of the islands (the Barlik) and the mainland of Ala-tau."

The expedition reached Kulja on November 14. Next year's programme is not quite settled, but a start will probably be made in January along the Chinese trade-route through Urumshi and Turfan to Hami.

Mr. Price returns to England from here, whilst Mr. Miller and myself will go eastwards. Our objective will be the Barkul-Hami group of mountains where geographical and zoological investigations will be carried on to prove whether this group really belongs to the Altai system rather than to the Tian-Shan, as the Russian explorers Grum Grijmailo believed it to be. Our work will then take us eastwards to the Aty-bogdo, of Kozloff, in the western part of the Gobi and further eastwards, if time permits.

EXPLORATIONS ABOUT MOUNT SIR SANDFORD, BRITISH COLUMBIA.*

By HOWARD PALMER, LL.B. (Harv.), F.R.G.S.

I. Introduction.

The Selkirk range of British Columbia includes some of the largest and most interesting tracts of unexplored alpine territory south of Alaska. Extending from the international boundary in a north-westerly direction for nearly 250 miles, the chain fills roughly the area comprised within the Big Bend of the Columbia and between its northerly and southerly courses. Right in the bight of this curious loop lies one of the most magnificent and least-known portions of the range—a fertile field for the explorer.† Though travel has passed around it through the Columbia valley since the early goldseeking days, and several mining trails penetrate its borders for considerable distances along the rivers, orographical knowledge about

* Map, p. 240.

† A. O. Wheeler, 'Selkirk Range,' vol. 1, pp. 232, 256, notes.

the tract as a whole is of the scantiest description. When viewed from the heights adjacent to the Canadian Pacific Railway, which crosses the system at about a third of its length from the northern extremity and bounds the *terra ignota* on the south, it presents a perfect sea of nameless peaks and glaciers, spreading out, wave on wave, to the horizon with scarcely a break. In the very heart of the district towers Mount Sir Sandford, the loftiest summit of the range yet determined. Its commanding height and conspicuous form led to its christening and measurement from a distance of 27 miles by the Government Survey; but down to 1909 no one had ever set foot upon the mountain or knew even a practicable way thither. The result by triangulation was 11,634 feet.*

II. Narrative.

A preliminary excursion† into this region in 1908, with Mr. B. S. Comstock of New York, revealed Mount Sir Sandford and its setting as of unusual topographical interest. Grandly castellated peaks, broad spreading *névés* and magnificent glaciers delighted our eyes on every hand and betokened a field well worth further investigation. Accordingly the next season the same party, with the welcome addition of Prof. H. C. Parker of New York, assembled at Golden, British Columbia, with this end in view. Profiting by a wider knowledge of the country, we expected to find a passable route to the mountain, to climb it if possible; but at any rate to explore the neighbouring glaciers and *névés*. We again engaged Manuel Dainard of Golden to outfit us and several woodsmen as packers.

Leaving Beavermouth (2435 feet), the most northerly station on the Canadian Pacific Railway, at noon on June 14, we dropped down the Columbia river in canoes for 19 miles, and then turned up Gold river, the first large western tributary beyond Beaver river. By dint of strenuous work against its 5-mile current with oar, pole, paddle, and rope, we reached a point some 3 miles from the mouth at nightfall, and set up the tents on a sandy bar (2300 feet). The next day we advanced a short distance further upstream with the boats, and then, caching them and packing the outfit on our shoulders, we continued along the west bank. After covering about 4 miles we reached the West Branch, and camped at 2600 feet‡ near its confluence with the main stream.

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* A. O. Wheeler, 'Selkirk Range,' vol. 1, p. 74.

† 'Appalachia' (Boston), vol. 12, No. 1, p. 16.

‡ This and the following heights mentioned, except where the contrary is indicated, were determined by aneroid. Owing to the lack of a near base station to which the readings could be referred, and to the sudden and frequent weather changes characteristic of the region, they are given to the nearest 100 feet only. In most cases, the figures represent the approximate averages of ascending and descending results, and they are based on an assumed altitude of 2300 feet for the confluence of Gold river with the Columbia. They are inserted here for whatever value they may possess as an indication of the relative relief.

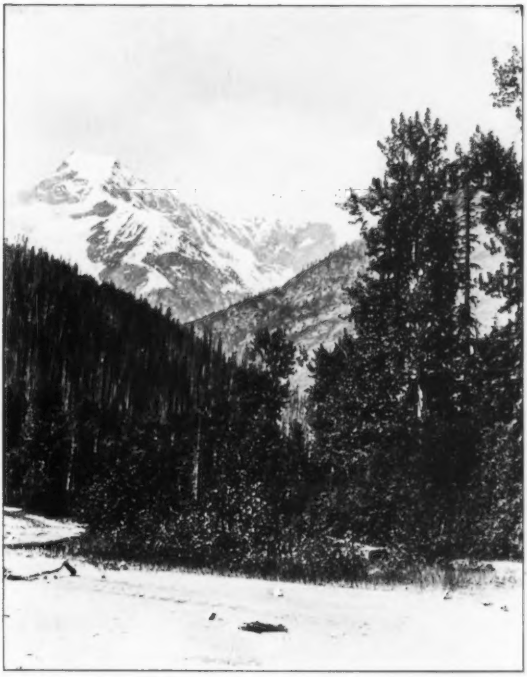
We knew that this fork flowed from Sir Sandford's glaciers and planned to follow its valley henceforward. Indeed, there was no alternative, for on the further bank the Sir Sandford range flung out a long wall of grim precipices, precluding any advance in that direction, and the opposite slope was too rough for a traverse above timber-line.

We found it anything but easy travelling. The valley was deep and narrow, with practically no floor. Its slopes, where not actually precipitous, fell down steeply to the stream, so that for much of the distance we had to make our way along the water's edge. In addition, they were mantled with a dense growth of evergreen forest, choked with alders, ferns, and devil's club.* Here and there avalanches had ploughed down through the trees on either side, leaving a tangled chaos of old trunks and branches. Occasionally their terrific impetus had taken them even to the torrent itself, as several thick snow arches bore witness. In these clearings the alders flourished with especial luxuriance, and only by vigorous chopping could they be passed. Green's vivid description of travel through similiar country to the south cannot be improved on (*Proc.* R.G.S., 1889, p. 165). The method of progression we finally adopted was to halt for a day or two in one place, until the men could locate a suitable advance camp, and hew out a trail to it with their axes. Then the whole party would move forward and the process be repeated. In this way we traversed the 12 miles to Sandford Camp, taking the same number of days. Most of the time hordes of mosquitoes pestered us, making gloves and headnets constantly necessary.

During the march, Mr. Comstock and the writer ascended to a commanding point on each side of the valley for topographical purposes. From Taurus Camp we occupied a prominent knob (7600 feet) on a northerly spur of Mount Taurus, covering the valley from Survey peak to Sentry mountain and a portion of the Columbia river. A day or two later from Mosquito Camp we climbed up the northerly slopes of the valley to the eastern summit of a massif, for which we propose the name Mount Stockmer (9000 feet). This was an important station, for besides giving us our first glimpse of Mount Sir Sandford's northerly faces, it enabled us to look over into the Columbia valley on the further side of the Giant's range.

From Mosquito Camp we proceeded on June 22 to Devil's Club Camp, so christened because of the quantity of these plants that we had to remove before the tents could be set up. It was situated in the neck of the valley on a small alluvial flat below a series of rocky steps that formed a hanging valley of the higher portion. Near by, the stream raced through a narrow canyon, from which it plunged with a dull roar into a cauldron worn out of the solid rock to a depth of 50 feet. Just above, the slit was bridged by a bank of avalanched snow, furnishing an

* *Echinopanax horridus.*



MOUNT TAURUS FROM VALLEY OF GOLD RIVER, NEAR THE COLUMBIA.

GIANTS RANGE FROM TAURUS STATION, SHOWING (FROM LEFT TO RIGHT) IN CLOUD BLACK GIANTS, MOUNT APPALACHIA, AND GOTHICS. GIANTS GLACIER LEFT CENTRE.

TONGUE OF GIANTS GLACIER FROM SANDFORD CAMP. MOUNT WOTAN IN BACKGROUND.

CLIFFS OF MOUNT SIR SANDFORD AND MINARET, FROM BASTION KNOB.

easy means of crossing. Unfortunately, it did not prove to be a permanent feature, for, upon our return later, the warm weather had left only a few fragments, and we had to get back by means of a felled tree.

On June 23 we visited the hanging glacier on the north side of the valley that we had seen from Taurus spur and named Giant's glacier. We followed the deep gorge of the West Branch beyond the cauldron to the fine waterfall, where its drainage shoots down over a cliff for several hundred feet in a white curtain of foam. Then, mounting the slippery, alder-matted slopes along its near margin, we reached the ice, 2600 feet above camp, about noon. The altitude was 6600 feet. The outlook was excellent, for it included the portion of the valley we had already traversed, as well as that ahead of us in the direction of Mount Sir Sandford. This, we were glad to see, would lead us directly to the tongue of the great glacier fed by its snows, nearly 3 miles away. We noticed with some misgiving, however, that the gorge offered rough travelling for men cumbered with heavy packs. Its densely timbered slopes opposite us descended to the torrent's edge in a series of steep flanking ridges and sheer-faced ribs, over which the streams tumbled in cascades.

On returning to camp, we learned that our apprehension was not unfounded. Dainard, who had spent the day with the men locating and clearing a trail, reported that the going was the worst yet experienced, but that they had finally reached the ice, and it was possible to get through with the packs. Our satisfaction at this good news, which meant the performance of the first part of our programme, was but short-lived; for presently Mr. Comstock announced that he must leave us and return to New York. On account of delays in starting and the slowness of our advance, the time originally estimated as sufficient for carrying out our plans was nearly exhausted, and pressing engagements there demanded his presence. It was with much regret that Prof. Parker and myself witnessed his departure on June 25.

The next day, having previously relayed part of our outfit, we climbed 1900 feet, and established camp at 5900 feet, on the crest of the moraine near Sir Sandford glacier, in a spot levelled off with our ice-axes. This we called Sandford Camp, and here our party, now reduced to four, spent the ensuing week.

On our first excursion we crossed the ice and walked 3 miles along the west lateral moraine, getting a good view of Mount Sir Sandford's stupendous cliffs. Its south-westerly *arête* sprang directly from them, sweeping up to a blunt snow-peak near by and forming a narrow col. In the centre, as if balancing on the *arête*, a slender minaret towered, its sombre mass making a striking contrast with the brilliant whiteness of sky and snow. Dwarfed by the proximity of Mount Sir Sandford, its aspect was puny, but we estimated the height as at least 400 feet.

June 29 we started out along the easterly margin and moraine of Sir Sandford glacier to visit this interesting col and ascertain the nature of Sir Sandford's southerly slopes beyond. Ascending the main ice-fall close under the bleak cliffs of the Bastion, we continued over piles of avalanched snow at an easy angle. The crevasses, though large, were not numerous, and our progress was rapid. Beyond the Bastion, however, conditions got worse. The snow was lightly crusted, and we broke through constantly. In addition a filmy vapour partially obscured the sun, diffusing its light in such a way that shadows were obliterated, and making it impossible for us to tell whether we were going to step into a hole or find solid footing. Directly ahead the curious minaret beckoned us on, and though we crunched steadily along, it seemed to stay as far away as ever.

Four hours after leaving camp, however, we arrived at a deep depression immediately beneath it. The trough resembled and occupied the position of a *bergschrund*, but we found that it was nothing but a hollow scooped out of the snow by the wind blowing through the col. This was still 100 feet above us, cut off by a difficult rock wall, over which a narrow snow-curtain formed the only passage. The snow was soft—nearly in an avalanching condition, but we managed to surmount it by carefully packing the steps. After this, a scramble up some threateningly loose rocks * brought us to the col, and at 12.30 we all huddled in its tiny nick, with scarce room enough to unshoulder our rucksacks. The altitude was 9000 feet.

It was a particular satisfaction to attain this point, for it commanded the grim southerly precipices of Mount Sir Sandford's massif, and we could all but see Cornice mountain, from which in 1908 I had viewed the range in nearly the opposite direction. There was nothing in sight, however, that promised an easier access to the mountain on this side. The face of the *arête* fell away beneath us perpendicularly, bare of snow, offering an eloquent example of what our route would probably be later in the season. A large glacier filled the cirque at our feet, cutting off the view into the depression of Gold river's main stream. An icy wind whistled through the notch, and the sun was hidden, so we stayed only long enough for our lunch and a few photographs, returning then over our tracks of the morning.

Up to this point we had only carried out the preliminary portion of our programme. For reconnoitring Sir Sandford, which from camp and the routes already traversed had presented a greatly foreshortened appearance, as well as for obtaining data for mapping the glaciers, an ascent to some

* The rock met with on this and other occasions when we were on the mountain seemed to be limestone. It was light grey in colour and very friable, breaking into small crystalline grains averaging one-eighth of an inch in diameter. It weathered easily into rough rounded surfaces both horizontally and vertically, which, combined with the gritty sand, produced a formation exceedingly unfavourable for rock climbing.

central point was essential. Accordingly, on June 30, I set out alone to climb Survey peak (as we later named it) that rose just across the glacier, and had been our guide up the lower valley.* The ascent of 2300 feet was easy, and the position of the peak all that could be desired. Situated in the midst of and equally distant from the encircling ranges, it supplied the key to the region's topography. Sir Sandford's soaring mass formed the dominant feature of the panorama, and I studied carefully the various possibilities of attack. Its north-westerly face from the summit down to within 2000 feet of the great glacier is a broad expanse of snowfield, cut by belts of protruding ice-cliffs much resembling those of Mount Victoria in the Rockies. When seen in profile from the Columbia, it appears to rise at an angle of less than 45°, and without more no particular difficulty would be anticipated in its ascent. Unfortunately, however, the long and gentle slope ends in unbroken precipices below, except at the westerly edge where an *arête* pushes out and swings upward at an easy curve to the Bastion. But, as if to make up for this seeming weakness, the mountain throws out, on the *arête* higher up, two difficult buttresses like dormer windows in a roof, placed one on top of the other and presenting steep snow and ice slopes to the north. Notwithstanding, this appeared on the whole to offer the best line of attack, for above the buttresses the *névé* and then the summit ridge looked accessible. After building a cairn visible from Devil's Club Camp and taking a round of angles and photographs, I descended to camp.

Next day we attempted the mountain by this route, gaining Bastion Knob (8800 feet) at the foot of the *arête* over the tracks of our previous trip to the col (see Plate 4). The party did not go beyond this point, however, for while discussing the various chances for advance, a huge mass of ice broke away from a hanging glacier and crashed down with a loud roar. Though it did not threaten any of the proposed routes, the majority took it as an indication of dangerous conditions above, and decided that further progress was unwise. One member, nevertheless, pushed on along the *arête* and gained the foot of the lower buttress, 500 feet higher, before meeting difficulties that could not safely be dealt with single-handed. Shortage of supplies prevented any further attacks upon the mountain, and the next day we turned homewards.

It was extremely hot in the valley, and the two days spent in reaching the canoe were the most exhausting on the trip. We found the Columbia in full flood, giving us the stiffest kind of pulling at the oars. Often progress was made only an inch at a time, and frequently two of us had to land and break through the thickets along the banks to lighten the boat and enable the men to work it up some difficult bit of water.

* I had visited the west or highest summit of the massif (later referred to as Survey mountain) two days before in unfavourable weather. By Survey peak is meant the rocky north summit.

In this way we finally regained our starting-point, on July 7, after twenty-three days of wilderness life.

III.—Geographical Description.

A. Sir Sandford Glacier and Tributaries.—The discovery of this splendid glacial system was, perhaps, the most important result of our expedition. Seen for the first time in its entirety from Survey mountain, the ensemble of rock, snow, and ice, relieved by scarcely a sign of the green world below, formed a prospect grand beyond description. Southward and westward, as far as the eye could reach stretched miles and miles of billowing snowfield. Four *névé*-laden ridges divided it into three catchment basins, from each of which a glittering stream issued to become confluent at length in the huge Sir Sandford glacier.

The trunk glacier of this trio flows northerly along the base of the Sir Sandford range for fully 7 miles. It is over half a mile wide at the narrowest point, and follows a nearly straight course throughout. An evenly crested, roof-shaped ridge, which was named the Palisade, bounds it on the west and separates it from the adjoining *névé* on that side. Between the Palisade and the Bastion occurs the chief ice-fall, occupying the full width of the glacier for a height of some 500 feet (Plate 5). The *névé* line appears near the southerly edge of the Bastion at about 7400 feet, and from here an undulating waste of snow sweeps away to the east, south, and west for 7 square miles. West of Mount Citadel, a col that we did not have opportunity to visit leads either into the valley of the main stream of Gold river or into that of some western tributary of the Columbia. Below the ice-fall the glacier is smooth and almost level until it approaches the final descent to the tongue, but here numerous longitudinal crevasses appear, and make the crossing somewhat troublesome.

The other two glaciers mentioned may be appropriately considered as one—the western tributary of the Sir Sandford—since they unite before joining the latter about a mile westerly from it. The larger branch, a full mile wide, stretches southward for perhaps four times this distance in a dazzling expanse of unbroken snowfield, separated from the Sir Sandford glacier by the long wall of the Palisade. The *névé* overtops the wall at its southern extremity, and joins that of the trunk glacier at its source, forming a nunatak of the Palisade. For this snowfield, Silvertip Nevé seems an appropriate designation. The other arm, smaller, shorter, and more crevassed descends from the northerly slopes of Mount Silvertip and a col further to the west. It is about 3 miles long, and we called it Silvertip glacier.

Besides this westerly tributary, the trunk glacier is augmented by yet another, which enters on the opposite side at the Bastion. Taking its source on the snowy ridge that forms a continuation of Sir Sandford's east *arête*, it sweeps across the northerly face of the peak and descends to join the main glacier 2 miles distant. We named it Dainard glacier.

With these ramifying arms contributing their icy quotas to one

SIR SANDFORD GLACIER FROM SURVEY MOUNTAIN, LOOKING SOUTH. CITADEL PEAK DISTANCE, BASTION IN FOREGROUND.

SIR SANDFORD GLACIER NEAR SANDFORD CAMP. SILVERTIP GLACIER IN MIDDLE DISTANCE. MOUNT SILVERTIP IN LEFT DISTANCE.

MOUNT SIR SANDFORD FROM SURVEY MOUNTAIN. DAINARD GLACIER AT THE LEFT.

SURVEY MOUNTAIN AND LOWER REACHES OF SIR SANDFORD GLACIER FROM ABOVE ICE-FALL. CLIFFS OF BASTION AT RIGHT. PART OF GIANTS RANGE IN BACKGROUND. SILVERTIP GLACIER JOINING SANDFORD GLACIER AT LEFT.

consolidated stream, the Sir Sandford glacier constitutes the largest and most interesting hitherto discovered in the range. The trunk stream, including the *névé*, occupies a distinct trough for some 7 miles, as above stated, but if the length of the tributaries be added, the result is more than twice this distance. The area of the whole is not far from 16 square miles. It is the best example of a dendritic glacier yet known in the Selkirks, surpassing in mass and total extent any of its competitors, among the southern ranges Battle glaciers, Grand glaciers, Black glacier, or Deville glacier.

The ice descends to an altitude of 5400 feet, and terminates in a smaller tongue than the number of arms and amount of *névé* in its reservoirs would lead one to expect. The final slope is gentle, sweeping down smoothly for several hundred feet unbroken by crevasses to a thin and unusually continuous lip. I sighted a line marked by prominent boulders across the end of the tongue, from which any future advance or retreat may be determined. Indications point strongly to a comparatively recent shrinkage in both length and volume, in the former case amounting to about a quarter of a mile. To the right of the snout (east) a huge mass has been completely severed from the main glacier by a brook that apparently forced its way through the lateral moraine, and plunged down over the ice. On the opposite side the glacier has encountered hard rock, and is more broken. The main drainage emerges near by and drops suddenly in a fall with a curious upward spout. The stream then makes its way in numerous channels across the moraine, and dashes into a narrow canyon cut through a vein of softer rock. About a quarter of a mile lower down there is still another canyon with walls that cannot be less than 100 feet sheer above the water. We noted several mineral springs strongly tinged with iron below the tongue to the right.

The surface moraines are small in comparison with the glacier's size. The largest extends from the Bastion for about 2 miles along the easterly margin, finally entirely covering the compressed portion of the Dainard glacier. From the Silvertip glacier on the opposite side a medial emerges and darkens the ice near the line of union. Aside from these, the system is practically free from surface morainic material. The ground moraine below the tongue appears to lie in a thin layer, for considerable reaches of bed-rock are exposed there and at either side.

A word about the former extension of Sir Sandford glacier may not be out of place. There is evidence that at one time it reached to the main valley of Gold river, for not only do all the large tributary streams issue from hanging valleys, but the valley of the West Branch itself is a hanging one, and its spurs are truncated. The torrent, however, has cut a deep canyon in the lip, and has now nearly reduced its grade to that of Gold river. A ridge resembling a terminal moraine extending from the west wall part-way across the main valley near the Columbia seems to indicate glacial work here also.

B. Taurus Glaciers.—This fine ice-sheet covers the northerly slopes of the Sir Sandford range from Dainard glacier to Mount Taurus. It has an area of some 6 square miles, and is chiefly remarkable for the way in which the easterly half, confined behind a lofty escarpment, flows nearly parallel to the range for several miles instead of directly into the valley.

C. Giants Range and Glacier.—The range of this name extends from Gold river to Silvertip col, lying between the valley of the Columbia and that of the West Branch. It culminates in the striking group of peaks shown in Plate 2, distant about 7 miles north-westerly from Sir Sandford. They comprise three main masses, and are arranged about the *névé* of Giants glacier in an imposing amphitheatre, walled with gaunt precipices. Mount Appalachia, as we called the central one, is the loftiest, and will work out in the vicinity of 11,200 feet. Next to the south, across a deep gorge the Black Giant's leap upward in twin rock-summits like petrified flames, while to the east, on the opposite side of the cirque, The Gothics (10,700 feet, ca.) tower in a forest of curiously up-tipped spires, second only to Appalachia in altitude.

The amphitheatre is defined on the south by a ridge connecting the East Giant with Survey mountain. It is about 2 miles in diameter, with a dish-like floor, and forms the reservoir for Giant's glacier. This flows out in an easterly direction and terminates on a steep rocky slant some 3 miles away (see Plate 3).

From The Gothics the range runs easterly, gradually decreasing in height. Its crest-line is sharp and jagged, nicked into many high cols by intersecting cirques. Several knife-edges zigzag valleywards, and form basins for decadent glaciers. One on the south-easterly slopes of Mount Wotan is still of considerable size. The opposite side of the range supports extensive snowfields, from which glaciers wind down towards the Columbia.

D. Gold River.—The main stream of Gold river heads to the west of Sir Sandford, and then flowing easterly along the south side of the range, parallel to the West Branch on the north, encircles its easterly termination, and continues northward to the Columbia. This places Sir Sandford considerably to the north-east of the main divide of the system, and gives it an exceptional location as compared with the highest peaks south of the railroad. Besides the West Branch, Gold river has only one other tributary of importance. This, the South Branch, joins it at the turn mentioned, flowing through a similar trough-like valley, and draining the great *névés* that lie to the south of Mount Sir Sandford. During the summer months the river is about 100 feet wide, runs at a rate of 5 or 6 miles an hour, and carries an immense volume of water. Crossing, accordingly, is a difficult and dangerous operation, and several parties have come to grief in attempting it. Near the mouth swamps and sloughs are to be found, which the river floods at high water.

Considerable confusion exists regarding the river's name. It is

variously called Gold creek, Gold stream, or Gold river. The latter has been adopted in the present paper as being most frequently used and, all things considered, the most appropriate.* Gold stream is generally understood to be restricted to an entirely different tributary of the Columbia on the westerly slope of the range; while river seems preferable to creek in conformity with the adjacent Beaver and Bush rivers, the former of which Gold river equals or surpasses in size.

RECENT EARTHQUAKES.

DURING the last two months there has been a period of unusual seismic activity. On December 14, at 11.40 a.m. (Greenwich mean time), a shock was felt at Zanzibar, which must have been strong over a wide area, for four of the Eastern Telegraph Company's cables between Zanzibar and Durban were broken. Seismographs in this country registered the first tremors about noon, and continued in oscillation for about two hours. On the 29th inst. continuous shocks were felt in the province of Elis, in Greece, especially in the area between Patras and Pyrgos. In this well-known seismic district buildings were much damaged, though no lives were lost. Two days later, on December 31, a shock lasting several seconds was felt at 4.41 a.m. at San Francisco, too weak to injure property, but strong enough to serve as a reminder that the crust in that region has not yet attained stability. On the same day, at Brusa in Asiatic Turkey, a strong earthquake occurred. The cupola of the mausoleum of Sultan Orkhan Ghazi was damaged, and the walls of several houses collapsed.

As usual, when earthquakes are strong and frequent abroad, symptoms of activity were also manifested in this country. On December 14, two slight shocks were felt at and around Glasgow, the first and stronger at 8.54 p.m., the second about an hour later. The former, which slightly disturbed the seismograph at Paisley observatory, was felt over an area of about 150 square miles, with its centre about 1 mile north-east of Renfrew, and close to one of the east and west faults in the Clyde valley, to a slip along which it was probably due.

None of the above earthquakes, with the exception of the first mentioned, attained the rank of world-shaking earthquakes. On January 1, however, a great disturbance was registered at many observatories. The position of the epicentre, as determined from the records of the Galitzin seismograph at Eskdalemuir observatory, was in lat. 36½° N., long. 66° E., in the Hindu Kush range to the north-west of Cabul. This was followed on January 3, shortly after 11 p.m. (Greenwich mean time),

* See Annual Reports of Department of Interior, Canada, for 1889, Part II. p. 35.

or January 4 (local time), by an earthquake of the first magnitude in Russian Turkestan. So violent was the disturbance that, in distant observatories, seismographs were displaced or injured. This was the case at Pulkova, and also in this country at West Bromwich, Cardiff, and Limerick. At Kew, though it is unusual for the magnetographs to register the passage of earthquakes, both the declination and horizontal force magnets were thrown into oscillation, the former beginning at 11.53 and the latter at 11.55 p.m. The first tremors were recorded by the Milne seismograph at Kew at 11.35 p.m., and the large surface waves at 11.47, when the limits of registration were exceeded for about a minute. This was followed by a lull in the great movements until about 11.54, when the limits of registration were exceeded, showing that the magnetographs were put into oscillation by the tilting of the ground. Nothing is known at present with regard to the limits of the area of destruction, but it certainly included Vyernyi and the northern shore of Lake Issil-Kul. The records of the Galitzin seismograph at Eskdalemuir place the epicentre in lat. 42° N., long. 77° E., that is, in the immediate neighbourhood of Lake Issil-Kul. The epicentral area must therefore coincide approximately with that of the great earthquake of June 9, 1887. Both are situated in a region of the most intense folding on the northern slopes of the Trans-Ilian Ala-tau, the axis of the epicentral area in 1887 being elongated in the direction of the folding. The Trans-Ilian Ala-tau range is one of those which constitute the Tian-shan mountains, the trend of which is concave to the north. The epicentral areas of the Vyernyi earthquakes thus lie, as is so frequently the case with other great world-shaking earthquakes, on the concave side of a mountain range, where the slopes are steepest and the crushing and sliding of the folded rock attain their chief development.

C. D.

THE ORIGIN OF THE MAJOR FEATURES OF THE GEOGRAPHY OF NORTHERN NIGERIA.*

By J. D. FALCONER.

THE salient features of the geography of Northern Nigeria are readily grasped (map, p. 183). The Protectorate is bounded on the north by the French Sudan, on the west by Dahome, on the south by Southern Nigeria, and on the east by the German Cameroons. The Niger and the Benue, with their tributaries the Kaduna and the Gongola, form the great waterways of the Protectorate, while the confluence of the two mighty rivers at Lokoja is counterbalanced, as it were, by the presence of Lake Chad in the north-eastern angle of the Protectorate. The south-eastern boundary runs through the rocky mass of the Shebshi hills, the Benue valley is limited to the north by the Wurkum and the Murchison hills, while the centre of the Protectorate is occupied by the great plateau of Bauchi, which rises to a height of over 4000 feet above the sea, and is marked off from the lower plains by precipitous walls on the north and south.

* Research Department, November, 17, 1910.

The scenery of Northern Nigeria bears in a general way a direct relationship to the character of the underlying rocks. Where horizontal sedimentary rocks, such as sandstones and grits, cover the surface, as in the valley of the Niger and on the lower and upper courses of the Benue, the typical scenery is that of low flat-topped ranges and plateau-like masses with narrow trench-like valleys and detached tabular and conical hills (Fig. 1). Where crystalline rocks form the surface rock, on the other hand, as in Hausaland, Borgu, Ilorin, Nassarawa and northern Yola, the characteristic type of scenery is that of the inselberg landscape, where open undulating plains are decorated by domes and turtle-backs of granite and isolated groups of rounded hills (Fig. 2). As exceptions to these rules, however, may be noted the middle Benue valley, where the great plain of Muri has been carved out of folded sand-stones, shales and limestones, and the belts of broken hilly ground which follow the strike of certain types of rock across the crystalline plains.

The Bauchi plateau whose surface presents all the characteristic features of a typical inselberg landscape is the hydrographical centre of the Protectorate (Fig 3). From it the rivers radiate north, south, east and west; but while at first they flow in such diverse directions they become ultimately included within one or other of the two great hydrographical systems, the Niger-Benue system and the Chad or Inland system. The primary watershed or dividing-line between the two great hydrographical systems runs from the northern boundary of the Protectorate to the east of Katsina southward with a sinuous course to the summit of the Bauchi plateau, whence it strikes north-eastward towards Bornu, and then south-eastward to the Yola border. Within the Chad system the only important river is the Yo, while the Yedseram, the only other large river of Bornu, forms, for some distance the boundary between Nigeria and the Cameroons. To the Niger-Benue system within the Protectorate belong a portion of the middle course of the Niger, with its larger tributaries the Kebbi, Kaduna, Gurara, Kampi and Mimi, and the middle and lower courses of the Benue, with its greater tributaries the Gongola, Tarabba, Donga, Katsena, Sungo and Okwa. In the west the primary watershed of the Niger system coincides approximately with the boundary of the Protectorate, while to the south of the Benue the primary watershed runs through Southern Nigeria and the Cameroons entirely beyond the limits of the Protectorate.

A striking peculiarity of the greater number of the rivers of Nigeria is that throughout their courses they present the exact reverse of the usual succession of mountain track, valley track, and plain track. Instead of drawing their headwaters from the slopes of jagged peaks they rise imperceptibly upon the swampy surface of elevated plains. Instead of flowing in their middle courses through ever-widening valleys they thread their way over gently undulating plains between and around the island mountains which decorate their surface: and instead of broadening out in their lower courses into wide and placid rivers with extensive flood plains on either hand, they flow with a rapid current in narrow trench-like valleys bounded by precipitous walls of rock. The hydrographical centre of the Protectorate, moreover, is not a group of rocky mountains, but the bare and treeless surface of an open plain, elevated 4000 feet above the sea. The primary watersheds are nowhere marked by ranges of jagged hills, but follow imperceptibly the crest lines of gently arching plains, and what hills there are appear to have had little or no influence in determining the courses of the greater rivers, and act only as secondary watersheds between the minor streams. The primary watersheds and the upper plains present all the characteristics of a mature topography, while the lower courses of the rivers, with their rapids and their trench-like valleys, exhibit an unexpectedly youthful appearance.

Another striking peculiarity of the surface of the Protectorate is that, contrary

to the rule in many parts of the tropics, any deep decomposition of the rocks *in situ* is a comparatively rare phenomenon. The little-weathered surface of the rocks is, however, deeply covered with a deposit of drifted or travelled alluvium which in places reaches a very considerable depth. The plains of Hausaland and Borgu owe their smooth and level surface very largely to this covering of drift, which obscures all the minor irregularities of the hummocky crystalline floor below and enwraps the bases of the scattered turtle-backs and isolated groups of hills. The rivers of Hausaland have cut their wide and shallow valleys in this sheet of drift, and are now actively engaged in its removal from the upper plains. Remains of similar deposits are found even on the highest parts of the Bauchi plateau, but, owing to the greater elevation, erosion is there more advanced, and only a few detached, flat-topped hillocks of drift are now left to tell the tale of its former extension (Fig. 4). These drift deposits of Northern Nigeria are nowhere now in process of accumulation. On the contrary, they are everywhere undergoing erosion. Their presence, however, affords some clue to the explanation of the peculiarities of the hydrography already indicated. It is abundantly evident that the drift deposits could not have accumulated upon the plains of Hausaland and upon the Bauchi plateau at their present elevation of 2000 to 4000 feet above the sea. On the contrary, they must have accumulated at a time when the surface of the Protectorate was at a much lower average level and at a time when the Bauchi plateau and the Nassarawa tableland had not assumed their present elevation above the plains of Hausaland, Nassarawa, and Muri. All the facts indeed point to an oscillatory movement of the crust in this part of Africa in late Tertiary or early Pleistocene times, as a result of which the surface of the Protectorate suffered alternate elevation and depression, with the consequently accompanying erosion and accumulation. The more recent movements may be summarized as: (1) a movement of elevation and consequent erosion during which a former sheet of weathered rock was removed from the surface of the Protectorate; (2) a movement of depression towards the close of which the drainage became uncertain and the drift deposits were spread out upon the surface of the Protectorate; and (3) a movement of elevation and accompanying erosion during a period which is continuous with the present.

It is to this most recent movement of elevation, which may be referred to the later Pliocene or early Pleistocene, that the establishment of the present river system is due. The elevation of the surface of the Protectorate from the neighbourhood of base level to an average height of 1000 feet above the sea was accompanied by a gentle flexuring of the crust into low arches and shallow troughs along axes which ran approximately W.S.W.–E.N.E. and N.N.W.–S.S.E. The two sets of flexures were produced practically simultaneously, and the present river system represents in a general way the adaptation of the drainage to the tectonic conditions resulting from the interference of the two sets of flexures (map, p. 183). The flexures may be termed respectively the α- and the β-flexures. Two α-arches, a northern and a southern, are distinguishable within the Protectorate. The northern runs from Borgu over the high plains of Kontagora, Sokoto and Katsina towards Machina and Zinder, and forms the watershed between the Gulbin Kebbi and its tributaries on the one hand and the Kaduna and the Yo on the other. These rivers may be presumed to occupy the shallow troughs on either side of the axial arch. The southern arch runs from central Kabba through Nassarawa and southern Bauchi into northern Yola, and the Benue may be presumed to occupy the trough to the south. Of the β-flexures, two axial arches may also be distinguished, a central and a western. The central is of a very partial character, and is recognisable only in the sinuous watershed which runs northward between the two α-arches from the

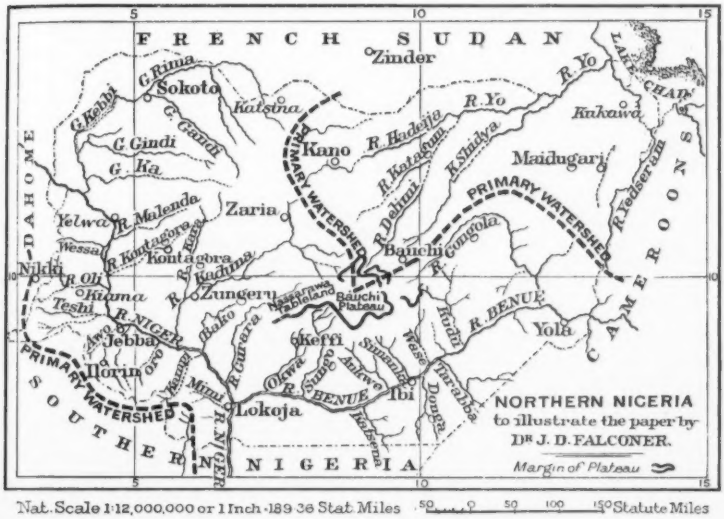
FIG. 1.—ON THE SUMMIT OF THE BAUCHI PLATEAU: THE PARADE-GROUND AT BUKURU.

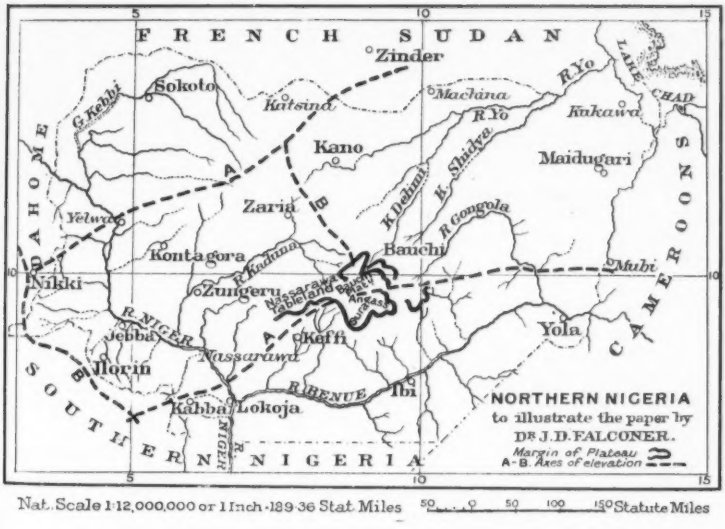
FIG. 2.—GRANITE KOPJE AND HILLOCK OF DRIFT ON THE BAUCHI PLATEAU.

FIG. 3.—LOKOJA AND MOUNT PATTI.

FIG. 4.—THE ABUJA ROCK. TYPICAL GRANITE MOUNT.

summit of the Bauchi plateau towards the Sokoto-Kano frontier, and separates the headwaters of the Kaduna from those of the Yo. The western arch forms in part





the western watershed of the Niger, and runs northward from the high plains to the south of Ilorin, approximately along the frontier of the Protectorate to the neighbourhood of Nikki in Dahomey.

The courses of the present rivers are thus clearly an adaptation to tectonic conditions. From the crests of the low extended arches the consequent streams were thrown off to pick a course for themselves over the drift-covered plains and between the solitary hills, and finally to unite to form the major rivers in the bottoms of the wide and shallow troughs. It should be remembered, however, that the elevation of the arches was in no sense catastrophic. The movement, for example, was evidently sufficiently slow to allow of the Niger cutting its way across the rising α-arches, a result which was rendered possible, however, only by the presence of soft and easily eroded sedimentary rocks in the river-bed. To the same reason also is to be ascribed very largely the contrast between the youthful character of the lower river-valleys and the matured aspect of the middle and upper courses. The trench-like valleys and dissected sandstone plateaux of their lower courses may reasonably be referred to the activity of the present rivers, but there can be little doubt that the turtle-backs and island mountains of the upper plains rose above the level surfaces of drifted alluvium long before the establishment of the present hydrographical *régime*. The central plains, indeed, possess an entirely antecedent character, and the rivers are only now beginning to cut their way slowly backward and downward into the harder crystalline rocks which form their floor. The whole drainage system, in fact, has suffered a complete reorganization and rejuvenation as a result of the recent elevation and flexuring of the surface of the Protectorate.

The river Gongola appears to have been diverted from its proper course towards Lake Chad by the presence of an earlier watershed in southern Bornu and northern Yola. The Chad area in the north-east occupies the trough between the two α-axes, and there is every reason to believe that, like the whole river system of Nigeria, the present lake is of comparatively recent origin, and in no sense a shrunken relic of an early Tertiary sea.

It is interesting also to trace the origin of the Bauchi plateau. The symmetrical elevation of the southern α-arch and the southward prolongation of the central β-arch were modified and interrupted by the formation of lines of weakness, longitudinally along the former and in the region of the intersection of the two arches. The relative influence of the forces which produced the flexures can be traced in the varying direction and sinuous character of the lines of weakness. Along these lines differential movements took place which resulted in the disproportionate elevation of the Nassarawa tableland and of the Bauchi plateau with reference to the middle Benue Valley and the northern plains of Bauchi. On the north the fracturing of the crust was confined only to the central region, while to the west and east the tableland and the plateau merged respectively into the general slope of the arch. On the south, however, a continuous line of fracture extended from Western Nassarawa by way of Darroro and Assab to Sura and Angass in Southern Bauchi. There is no reason to believe that the southern α-arch, as a whole, ever reached the elevation of the Bauchi plateau, or that the plateau originated in any sense as a "horst," separated from the adjoining tableland and the plains of Nassarawa and Muri by the later differential subsidence of the latter. On the contrary, the movement appears to have been in one direction only, and characterized by the differential elevation of the plateau and the tableland above the plains of Nassarawa, Muri and Northern Bauchi.

The isolated domes and kopjes and detached groups of hills which form the most striking feature of the higher plains are characteristic also of all the older gneissic areas of Africa, and the question of their origin has given rise to considerable difference of opinion. The particular type of scenery to which they give rise has been termed by German writers the "Inselberglandschaft." Passarge sees in them the product of arid conditions, and concludes that the surfaces which they characterize assumed their present character for the most part in early Mesozoic times when the

greater part of Africa was a barren desert. Bornhardt, on the other hand, believes that the inselberge have arisen as the result of the superposition of several cycles of erosion. There is, however, no reason to believe that this peculiar topography cannot arise simply through an alternation of periods of weathering and periods of erosion, brought about either by a gentle oscillation of the crust or by a repeated base-levelling of the plains and rejuvenation of the drainage system. A plane surface of granite and gneiss subjected to long continued weathering at base level would be decomposed to unequal depths according to the composition and texture of the various rocks. When elevation and erosion ensued the weathered crust would be removed and an irregular surface would be produced from which the more resistant rocks would project. Those rocks which had offered the greatest resistance to chemical weathering beneath the surface would upon exposure naturally assume that configuration of surface which afforded the least scope for the activity of the agents of denudation. In this way would arise the characteristic domes and turtlebacks, which suffer further denudation only through insolation and exfoliation. A slight subsequent movement of depression would suffice to cover with drift large areas of the irregular surface between the domes and to produce the characteristic topography of isolated and rounded hills rising abruptly from the level surface of the plains. It should be remembered, however, that, as already indicated, the inselberge, as we see them now, are of no very recent origin; and while it is unnecessary to go so far as to say with Passarge that they date back to pre-Cretaceous times, there can be little doubt that they are at least antecedent in origin to the present river system. This is indeed sufficiently obvious when it is remarked that the present courses of the rivers bear absolutely no relation to the position of the inselberge. The present rivers, indeed, are merely the result of the adaptation of the drainage to the changed tectonic conditions, and are in no sense responsible for the character or sculpture of the plains.

Prof. J. L. Myres (before the paper): We begin this session of the Research Department with a paper by Dr. J. D. Falconer on the "Origin of the Major Features of the Geography of Northern Nigeria." The paper has been circulated for discussion, and I will ask Dr. Falconer to give us a summary of the main points in it, and to direct our attention to the questions on which he would most like criticism and discussion.

Dr. J. W. Evans (after the paper): We must congratulate Dr. Falconer on his interesting account of a type of scenery which is still comparatively little known, and at the same time presents a number of important problems for solution. The hummocky plains he describes are by no means peculiar to Africa, for we find a very similar surface on the Deccan plateau in India, and, modified by ice action, in the great plains of Canada and Sweden, which consist, like those of Northern Nigeria, of gneiss and crystalline schists. This form of surface is not the result of the long-continued action of running water, but must be attributed to the decomposition of the rock by atmospheric agencies. On the north-eastern slopes of the Bolivian Andes below a height of 7000 or 8000 feet, where the rainfall is heavy and vegetation abundant, I found the slates converted into a soft red clay-like substance to a considerable depth, and under similar conditions all rocks containing aluminium silicates are acted on in this way. The resulting decomposed material is easily removed by streams or glaciers. The variations in the depth to which the decomposition has penetrated, may be explained by differences in the amount or kind of vegetation, in the saturation of the soil, and in other superficial conditions; but they are, no doubt, also determined to a considerable extent by the nature of the rocks and their jointing. Running water appears to preserve a rock from decomposition, though, of course, it exercises abrasive action upon it.

The fact that decomposition is not now taking place in Northern Nigeria is unimportant. It may easily date back to earlier—even pre-Cretaceous—times, when the climate was more humid.

The larger masses that project, the "Inselberge," are due, according to my own experience in South India, to the occurrence of rocks which resist decomposition more than the surrounding country. In special cases, however, they may be accounted for by the former existence of some protective material, iron-pan for instance, above them.

Dr. Falconer tells us that the present drainage system is of a later date than the formation of the main surface features. Is it not possible that it originated at a time when the whole country was still covered by Cretaceous and Eocene rocks, and that it is an "impressed" drainage similar to that of our Lake District, as explained by Dr. Marr? I should like, therefore, to ask Dr. Falconer whether the earth-movements that he describes took place, in his opinion, before or after the removal of these Cretaceous and Eocene rocks from the higher ground.

The special features of the Northern Nigerian rivers, their commencement on a rocky level plain over which they flow with a gentle current, and their subsequent deeply incised course and rapid descent, are not unknown in other regions; for instance, the great plains of Canada already alluded to, the watershed between the Amazon and the La Plata, and that in Patagonia between the Atlantic and the Pacific. It is a youthful, not a mature, type of drainage

Mr. Kitson: In his most interesting paper, Dr. Falconer has described some fine examples of geographical features similar to those I have seen in Southern Nigeria and Dahomey. What he has said regarding their origin calls for careful reflection. There are several points to which reference may be made, and though geological, they bear directly upon the geographical development of the country. What is the relation, if any, between the Eocene marine deposits of the Sokoto region in Northern Nigeria and the early Tertiary (?) freshwater deposits of the Niger valley in Northern and Southern Nigeria? Are the former wholly marine or a combination of marine, estuarine, and fresh-water beds? In Southern Nigeria, resting alike on crystalline and sedimentary rocks, there is a widespread sheet of clayey sands, called the "Benin Sands," by Mr. Parkinson. Do these sands occur in Northern Nigeria? If so, what are their associated rocks and their relation to them? Are they found on the Bauchi plateau, in Northern Yola, and towards Lake Chad? What is the prevailing strike of the crystalline rocks in Northern Nigeria? In Southern Nigeria the rocks have a general meridional strike, and the river system is closely related to the physical disposition of the rocks. The streams have eroded their channels mainly along the lines of strike. Apart from the occurrence of similar drift at different altitudes, what is the evidence of displacement along the edges of the Bauchi plateau? There appears to be evidence of differential elevation in Southern Nigeria, though not to the degree suggested in Northern Nigeria. The varying relative positions occupied by post-Cretaceous fossiliferous marine and fresh-water deposits in different districts in the former colony suggest differential elevation or faulting.

There is no doubt that steady elevation of the South Nigerian coast, and probably of the whole of the Guinea coast also, is taking place at the present time. The formation of the great Niger delta has been materially aided and accelerated by the assistance given to the deposition of the river sediment by the accompanying raising of the sea-bed; and similarly the rise of the land is aiding the sea in the formation of the great bars of sand that fringe the coast. In the eastern and central provinces of Southern Nigeria, my observations have shown clearly that there have been two or three phases of land elevation. During one

phase the country has suffered great denudation between the Udi plateau and the Cross river, where a great plain has been carved out of Cretaceous rocks, which shew a transition westwards from marine, through estuarine to fresh-water deposits. On the western side of this plain is a great scarp cut through by numerous streams flowing through deep valleys into the plain. The valleys trend from the Udi plateau, itself apparently of the same type as some of the plains Dr. Falconer has described in Northern Nigeria. The Udi plateau has the Inselberg type of sculpture. Conical and flat-topped hills rise out of a generally plain surface of loose sandy deposits. The conical hills owe their shape to protective caps of ferruginous claystones; the flat-topped hills are simply the evidence of less matured weathering, and will become conical ones later on. Since the formation of this great plain on the east the country has experienced successive slight uplifts, and new cycles of erosion have followed, as evidenced by the entrenched valleys of various streams.

The origin of the dome-shaped hills is very puzzling. In Southern Nigeria they occur in a great crystalline complex, consisting of granites, gneisses, schists, altered sedimentary, and igneous rocks, with innumerable dykes of granite and other rocks of different kinds and ages. There is evidence of great dynamic action during different periods and of differing intensity. In some cases these hills consist of almost unaltered intrusive granite; in other cases the granite is distinctly foliated with numerous later intrusions of normal granitoid rocks; others consist of gneisses, intricately contorted. All types show in many cases distinct spheroidal jointing, either cutting at all angles across or almost coinciding with the strike of these rocks. It is obvious that the shape of these hills, which are essentially domes, have been developed by the exfoliation of huge masses of rock.

That is, to my mind, the important feature, for, unaided by the physical character of the rocks, differential decomposition *in situ*, followed by sub-aerial denudation—whether or not both had several alternations—cannot, I think, account for the shape of the hills. Surface decomposition, as we know, must have developed to a much greater extent in past times than is the case now. The evidence in West and North Africa of the existence there during Cretaceous and Tertiary times of a great sea or seas, shows that the climate of Northern Nigeria must then have been much moister than at present, and dense forests must have stood where now we have treeless plains. Consequently decomposition of the rocks must have been greater and quicker than now, and thick deposits must have accumulated, to be easily and quickly taken away by stream and wind action when suitable conditions arose. But chemical and erosive action together, without material aid from the physical character of the rock masses, do not appear capable of explaining the origin of the hills.

As regards the suggestive southward bend of the Gongola, has Dr. Falconer rejected the possibility of the upper portion being the captured part of a former river draining into Lake Chad?

Mr. T. Crook: I am somewhat perplexed with Dr. Falconer's use of the term "drift." He appears to include under this term not only transported material, such as ordinary alluvium, but also sedentary weathering-products which have suffered little or no lateral displacement from the rocks whence they have been derived. I should like to ask Dr. Falconer to what extent the Bauchi plateau "drift" includes weathering-products which are either sedentary or merely locally re-sorted. If it be genuine alluvium which has been to any considerable extent transported, has he any suggestion to make as to the probable location of the area from which it has been derived? This area, at the time the

alluvium was formed, presumably existed at a relatively higher level than the present level of the plateau. In view of the important part which the plateau "drift" plays in Dr. Falconer's views as to the age of the crust-movements which have determined the present drainage features, it would be interesting to have further details concerning its exact nature and origin.

Mr. E. O. THIELE: I would like to thank Dr. Falconer for his interesting paper, but as so many questions have been asked already, it would lengthen the discussion unduly should I take up much more time. In passing, however, I would just like to ask one question, and that is, if there is any evidence of fresh-water Cretaceous in Northern Nigeria?

Dr. J. D. FALCONER: I agree with Dr. Evans that the Inselberge have arisen largely through differential decomposition *in situ*, and there is little doubt that the surface rocks of Northern Nigeria were in this way at one time extensively and deeply decomposed. I agree, also, that the present type of drainage possesses a very youthful character, the crustal movements to which it owes its origin having taken place within comparatively recent times, and long after the removal of the Cretaceous and Eocene rocks from the central crystalline area of the Protectorate.

As regards Mr. Kitson's queries, the Middle Eocene rocks of Sokoto, which consist of a marine series below and a shallow-water series above, are continuous with the shallow-water, and possibly in part lacustrine series, of the middle Niger valley, and may possibly be represented by fresh-water deposits in Southern Nigeria. It is conceivable, also, that the "Benin sands" of Southern Nigeria may be of contemporaneous origin with the drift of Northern Nigeria, but upon this point no definite pronouncement can yet be made. The gneisses and schists of Northern Nigeria show, for the most past, the same meridional strike as they possess to the north and south of the Protectorate, but the major rivers without exception run transverse to the strike, and exhibit absolutely no relation to the disposition of the underlying rocks. The fractured character of the margin of the Bauchi plateau is deduced from several lines of evidence; but, as is usually the case in crystalline areas, the actual lines of displacement cannot be positively demonstrated. With reference to the dome-shaped hills, I agree that the spheroidal jointing and the original phacolitic character of many of the intrusive granite masses have had much to do with the definition of their present outlines, but it is difficult to see how these factors can contribute much to the original sculpture of an Inselberg landscape. As regards the bend of the Gongola, I have, after much consideration, rejected the obvious possibility of the upper portion having been captured in the usually accepted sense of the term. There is some evidence that, from the bend southwards, the Gongola flows in an earlier river valley, but there is no evidence that the upper portion of the river ever drained into Lake Chad.

In reply to Mr. Crook, the drift of Northern Nigeria is largely of local origin, resorted and rearranged by the action of such agents of transportation as are still active in the Sudan. I take it that the drift has for the most part been derived from the erosion of portions of an earlier sheet of weathered rock, and while there is no necessity to postulate any extensive transportation of the material, there seem to have been certain areas of maximum accumulation within the Protectorate towards which the weathered and disintegrated material naturally tended to travel. As regards Mr. Thiele's inquiry, fresh-water beds are as yet unknown amongst the Cretaceous rocks of Northern Nigeria.

Prof. MYRES: Dr. Falconer has condensed for our information a very large quantity of valuable original work, and I am sure we wish to express to him our

thanks for the way in which he has presented his paper to us. I should like to thank him particularly for his admirable illustrations of types of scenery which are not familiar to us who live in these more temperate regions. I think we ought also to express our thanks to those other geologists who have contributed to the discussion this evening. The paper has raised many questions, and we have been fortunate in eliciting a number of very valuable criticisms in the course of the discussion.

THE TERMS "DENUDATION," "EROSION," "CORROSION," AND "CORRASION."

By J. W. GREGORY, F.R.S.

Professor Bonney's Presidential Address to the British Association has directed attention to the relative importance of ice and water as geographical agents. The international discussion of the relative efficiency of the various processes that mould the surface of the Earth is handicapped by the development during recent years of different meanings in Europe and America for the chief terms used in the classification of these processes. The important terms "denudation," "erosion," "corrosion," and "corrasion" have become ambiguous.

Denudation.

"Denudation" is the term well established in this country for the general result of all the agencies that wear away the surface of the Earth. This process was at first described as the "degradation" of the land, as by de la Beche in his 'Geological Manual,' 1831 (p. 40), and by Lyell, in 1832, in the first edition of his 'Principles,'* though he therein also spoke of land surfaces having been "denuded" (*op. cit.*, p. 198). Lyell soon came to prefer the term "denudation," which he formally proposed in 1833,† and defined in his Glossary ‡ as follows: "Denudation. The carrying away of a portion of the solid materials of the land, by which the inferior parts are laid bare. Etym., *denudo*, to lay bare." Later, however, Lyell limited denudation to the action of running water. Thus, in 1841, he states that "Denudation, which has been occasionally spoken of in the preceding chapters, is the removal of solid matter by running water, whether by a river or marine current, and the consequent laying bare of some inferior rock."§ The same view was repeated in his Glossary of 1847: "Denudation. The carrying away by the action of running water of a portion of the solid materials of the land, by which inferior rocks are laid bare. Etym. *denudo*, to lay bare."‖

Lyell's restriction of denudation to the action of running water has not been generally adopted. Thus, in 1843, Humble's definition refers to water action only in the third rendering of the term: "Denudation (*denudatio*, Lat.; *denudation*, Fr.). The laying bare: the act of divesting of its covering; the uncovering of strata by the washing away of their covering."¶

Page's definition—"Denudation (Lat. *de*, down, and *nudus*, naked). Laying bare by removal. The removal of superficial matter, so as to lay bare the sub-

* C. Lyell, 'Principles of Geology,' vol. 2, p. 200. 1832.
† *Ibid.*, vol. 3, p. 30. 1833.
‡ *Ibid.*, vol. 3, Appendix, p. 67. 1833.
§ C. Lyell, 'Elements of Geology,' vol. 1, p. 137. London: 1841.
‖ C. Lyell, 'Principles of Geology,' 7th edit., p. 774. 1847.
¶ W. Humble, 'Dictionary of Geology and Mineralogy,' p. 71. 1843.

jacent strata, is an act of denudation; so also the removal by water of any formation, or part of a formation. We thus speak of denuded rock-surfaces, and of strata destroyed or removed by denudation" *—shows a more complete abandonment of the view that denudation is due to water alone. The present acceptance of the term in this country for any process of laying bare fresh surfaces of the Earth's crust may be shown by reference to its use by Sir Archibald Geikie,† by the twelfth chapter entitled "Structures resulting from Denudation," in Prof. James Geikie's latest text-book,‡ by Prof. A. J. Herbertson,§ and by the definition in the most recent British text-book—that of Lake and Rastall.‖

Denudation is unquestionably the standard British term for the combined effect of all processes of terrestrial degradation. It was once also well established in America. It was used in its wide historic sense by Dana,¶ Dutton,** and le Conte,†† and is still adopted by Prof. W. M. Davis.‡‡ In recent years, however, the term has been abandoned by many American authors, who adopt the term "erosion" instead. The use of erosion as synonymous with denudation is apparently due to Dr. G. K. Gilbert, in the famous chapter on land sculpture in his monograph on the Henry mountains. Gilbert there defined erosion in the following passage: §§ "All indurated rocks and most earths are bound together by a force of cohesion which must be overcome before they can be divided and removed. The natural processes by which the division and removal are accomplished make up erosion. They are called disintegration and transportation." He divided erosion into three divisions—weathering, transportation, and corrasion. Gilbert's classification and terminology are adopted by Chamberlin and Salisbury ‖‖ in their 'Geology,' Salisbury ¶¶ in his 'Physiography,' and in this country by Lake and Rastall, though they speak of denudation as the process and erosion as the result.

The disfavour and partial disuse of the term "denudation" is doubtless due

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* D. Page, 'Handbook of Geological Terms. Geology and Physical Geography, 2nd edit., p. 172. 1865.

† A. Geikie, 'Text-Book of Geology,' 4th edit., vol. 2, p. 1364. 1903.

‡ J. Geikie, 'Structural and Field Geology for Students of Pure and Applied Science,' pp. 175–181. 1905.

§ A. J. Herbertson, 'Outlines of Physiography. An Introduction to the Study of the Earth,' p. 160 (1901). "The sum-total of forces decomposing the Earth's surface are known as denuding (Lat. *de*, denoting removal, and *nudus*, naked) forces. Those due to the action of the atmosphere alone are called weathering forces; those due to the action of moving water as erosive (Lat. *erodo, erosum*, to eat away) forces. Weathering and erosion are, therefore, the two special causes of denudation."

‖ P. Lake and R. H. Rastall, 'A Text-book of Geology,' p. 27. 1910.

¶ J. D. Dana, 'Manual of Geology,' p. 679. 1870.

** C. E. Dutton, 'Tertiary History of the Grand Cañon District,' Mon. II., U.S. Geol. Surv., p. 61. 1882.

†† J. Le Conte, 'Elements of Geology,' 5th edit., by Prof. Fairchild, pp. 284–289. 1903. He includes marine action and adopts erosion in a narrower sense than Dr. Gilbert (p. 9).

‡‡ W. M. Davis, 'Geographical Essays,' edited by D. W. Johnson, p. 79. 1910.

§§ G. K. Gilbert, 'Report on the Geology of the Henry Mountains,' U.S. Geogr. and Geol. Surv. of the Rocky Mountain Region, Washington, pp. 99–100, 1877. Gilbert's views were announced a year earlier in a preliminary paper, "The Colorado Plateau Province as a Field for Geological Study," *Amer. Journ. Sci.*, Third Series, vol. 12, pp. 85–103. 1876.

‖‖ T. C. Chamberlin and R. D. Salisbury, 'Geology,' vol. 1, 'Geologic Processes and their Results,' p. 105. 1904.

¶¶ R. D. Salisbury, 'Physiography,' p. 129. 1907

mainly to the vague and various meanings in which it has been used. There have been two main variations in its use.

1. It is interpreted in a wide sense, as by Sir Archibald Geikie * and Sir Joseph Prestwich,† for the general lowering of the land by all the attacking forces, including both subaerial and marine agencies.

2. It is used, especially by German geographers, in a more limited sense which is in stricter agreement with its etymological meaning of "laying bare." It is thus confined to subaerial action, while the cutting back of the land by the sea is described as abrasion.‡

As Supan § adopts this restricted interpretation and recognizes the need of some term to cover both the subaerial and marine wearing away of the land, he proposes "destruction" as equivalent to the wider use of denudation.

Denudation and Erosion.

The term "denudation" is, however, sometimes abandoned and replaced by "erosion," as defined by Dr. G. K. Gilbert.‖ This use of the term does not distinguish between denudation as the name for the general result of land sculpture, and erosion as one of the processes by which denudation is effected.

That denudation should be distinguished from erosion has been clearly pointed out by Prof. Penck.¶ He once adopted the term "denudation" in its wide sense, as is shown by the title of his paper "Die Denudation der Erdoberfläche" (Vienna, 1887); but he now limits denudation to the exposure of fresh rock surfaces by the removal of the weathered crust. Denudation is thereby represented as a widespread and superficial action, while Penck defines erosion as the gnawing away of fresh undecomposed rock by the passage across it of mechanically transported material. Both Günther ** and Supan †† agree with Penck in regarding denudation as a distinct process from erosion.

Erosion.

Gilbert, however, introduced the word "erosion" in a much wider sense, and including weathering, transportation, and the erosive action of moving water.

The term "erosion" apparently came to us from Latin through French. It is derived from the Latin verb *erodere*, which is composed of *e*, "out," and *rodere*, "to gnaw." Murray's Oxford Dictionary defines its meanings as "to gnaw away," and that is obviously the correct interpretation. Gnawing is mainly a mechanical process, but some measure of solution may accompany it; and erosion has been used to include chemical solution by Huxley,‡‡ where he speaks of the power of water to dissolve carbonate of lime and thus "erode the limestone rocks." As erosion means gnawing away, the inclusion of rock transport in the process seems

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* A. Geikie, 'Text-Book of Geology,' edit. 4, vol. 2, p. 1364. 1903.

† J. Prestwich, 'Geology,' vol. 1, p. 460. 1886.

‡ As, for example, by von Richthofen, 'Führer für Forschungsreisende' (reprint of 1886 edition), p. 492. Hannover: 1901.

§ A. Supan, 'Grundzuge der Physischen Erdkunde,' 4th edit., p. 457. Leipzig 1908.

‖ G. K. Gilbert, *op. cit.*, p. 100.

¶ A. Penck, 'Morphologie der Erdoberfläche,' vol. 1, p. 245. 1894.

** S. Günther, 'Handbuch der Geophysik,' vol. 2, 2nd edit., p. 884. 1899.

†† A. Supan, *op. cit.*, p. 458. Supan accepts erosion as the work of moving water, ice, or air.

‡‡ T. H. Huxley, 'Physiography,' p. 119. 1877.

hardly appropriate, though erosion supplies loose materials which are rendered available for transport. Gnawing away is also an unsuitable description of the slow widespread superficial decay of rocks by weathering.

British authorities from Lyell onward have used erosion for the more direct and concentrated forms of attack, such as wind erosion, glacial erosion, or the attack of the sea upon exposed cliffs. Weathering decreases the resistance of rocks to erosion, but is not itself a part of the gnawing-away process. I do not remember the application of the term "erosion" to the decay of a building stone by weathering, unless the weathering agent has definitely eaten into the stone.

Page's definition of 1865, "Erosion (Lat. *erosus*, gnawed or worn away). The act of gradually wearing away; the state of being gradually worn away; *e.g.* 'valleys of erosion,' or those valleys which have been gradually cut out of the solid strata by the long-continued action of the river or rivers that flow through them," * is an example of the still current British use of the term. Thus Sir Archibald Geikie speaks of wind erosion, erosion by rain, and marine erosion.† Prof. Bonney ‡ uses erosion similarly, and as an example of French usage, de Lapparent § used erosion in its wide sense, and did not appear to adopt either corrosion or corrasion.

Corrosion.

Though erosion is therefore used by British authors in a less wide sense than by Gilbert, it included all forms of active attack on the land by the more vigorous geographical agents. There have been several proposals to restrict its use. Thus Walther proposes the special term "deflation" for wind erosion, and "exaration" for glacial erosion. A still more important limitation has been suggested by Powell's luminous conception of the "base-level of erosion," which renders very useful the clear distinction between the lateral and basal attack by agents that destroy the land. This distinction is especially helpful in the case of river action.

The "base-level" is first reached in a country that is undergoing dissection by the rivers cutting down their beds till they reach their base-level; the lateral denuding agents, which had already begun their work, would then continue until all the country is worn down to its base-level.

Powell, when introducing the term "base-level," clearly distinguished between the lateral and vertical wearing away of the land. He distinguished "First corrasion by running streams, and second, erosion by rains; the first producing channels along well-defined lines, the second producing the general surface features of the landscape." ‖ Corrasion, he points out, produces canyons, while erosion wears away the cliffs, either by undermining in an arid climate, or by surface washing in a moist climate.

Dutton, ¶ in his classic monograph on the 'Grand Canyon of the Colorado District,' used corrasion in the same sense; he repeatedly expresses the distinction between the erosion of the cliffs and the corrasion of the bed of rivers.

Supan ** subdivides erosion into two processes, ablation and corrosion, and

* D. Page, *op. cit.*, p. 193.

† A. Geikie, *op. cit.*, pp. 426, 462, 573.

‡ T. G. Bonney, 'The Story of our Planet,' pp. 119, 121. 1893.

§ A. de Lapparent, 'Leçons de Géographie Physique,' chap. 8, p. 29. Paris: 1907.

‖ J. W. Powell, 'Exploration of the Colorado River of the West and its Tributaries. Explored in 1869, 1870, 1871, and 1872,' p. 205. Washington: 1875.

¶ C. E. Dutton, 'Tertiary History of the Grand Cañon District,' Mon. U.S. Geol. Surv., No. 2, pp. 119–121. 1882.

** A. Supan, *op. cit.*, p. 458. 1908.

practically uses corrosion for vertical excavation, for he describes it as being the wearing away of firm undecomposed rocks by the file-like action of transported material.

Penck also defines corrosion as wear and tear by mechanically transported material.* No doubt transported material has occasionally a lateral action, where a stream impinges against a cliff; but even there it is generally the deepening of the channel that renders the bank unstable, and leads to its fall before the attack of wind, rain, and frost. The lateral action of transported material even in the case of wind action must be insignificant compared with its vertical digging action.

Prestwich,† adopting the term "erosion" for river excavation, speaks of the mechanical action of water-borne material as the "corrosive action." The use of the term "corrosion" for the basal action of a denuding agent, in contradistinction to erosion for the more widespread lateral action, seems to me, therefore, in accordance with Powell's original use of corrasion, and to have the support of high subsequent authorities.

I have accordingly used corrosion in that sense in the 'Geography of Victoria,"‡ 1903, and in "Structural Geography." §

Corrasion.

It may be said that it would have been better to follow Powell and use corrasion instead of corrosion for this vertical excavation. There seems, however, three weighty objections to the term "corrasion."

1. Though the term, according to Penck, was first used by early French geologists, it was apparently introduced into current geology by Powell‖ for basal excavation, for which various subsequent geologists have adopted the spelling corrosion. But corrasion has been adopted by many American geologists in a different sense, following the course proposed by Gilbert,¶ according to whom that part of rock disintegration "accomplished by running water is called corrasion." He describes corrasion as mainly a mechanical effect due to the friction of transported material over the beds of rivers. He says, "There is a constant comminution of all the material as it moves, and the work of transportation is thereby accelerated. Boulders and pebbles, while they wear the stream-bed by pounding and rubbing, are worn still more rapidly themselves."** He remarks (p. 102) that the agents of corrasion are solution and mechanical wear, of which the latter is the more effective.

The term "corrasion" comes from the Latin *corradere*, from *cor* = *com*, "together," and *radere*, "to scrape." Both Murray's Oxford Dictionary and the Century Dictionary agree that its primary meaning is "to scrape together," as illustrated by the sentence "wealth corraded by corruption," quoted in the Century Dictionary.

The Oxford Dictionary, however, gives as a second meaning for *corrade*, "to

* A. Penck, *op. cit.*, p. 245. So also does Richthofen ('Führer für Forschungsreisende,' p. 133. 1901), as in his definition of Korrosion, "Die Reibung der suspendierten Teile gegen die Wände des Kanals," the "Wände" must include the bed (cf. also pp. 148, 245).

† J. Prestwich, *op. cit.*, p. 97.

‡ J. W. Gregory, 'The Geography of Victoria: Historical, Physical, and Political,' p. 98. Melbourne: 1903.

§ J. W. Gregory, 'Geography, Structural, Physical, and Comparative,' p. 47. 1908.

‖ J. W. Powell, *op. cit.*, p. 179.

¶ G. K. Gilbert, *op. cit.*, p. 100.

** *Ibid.*, pp. 101, 102.

scrape, to wear down by scraping," as used by Sir Thomas Browne in 1646; this might be a precedent for the use of the word as a general agent of degradation; but it does not support its use for basal excavation; for scraping is a levelling process, wearing down surface irregularities, rather than causing them by corrosion. The term corrasion is still used in the sense of this general surface scraping by some French geographers, such as Prof. de Martonne of Lyons,* who uses it for the natural sand-blast on fresh rock surfaces; although he gives a figure (pl. xxxiii*b*) in which the sand action has had a powerful effect in gnawing into a bare level rock surface, and he there calls that process "erosion." Prof. Günther also adopts corrasion in the same sense as Prof. de Martonne's text; he defines Korrasion † as "erosive wearing away of rock excluding that of evorsive ‡ character;" he therefore adopts corrasion, but excludes from it the most effective process of downward excavation by rivers.

The term "corrasion" has also been used with the meaning of corrosion, as by Webster in the 'Duchess of Malfi' in 1672; but according to the Century Dictionary this use was simply a mistaken spelling for corrosion. Corrasion, in the sense in which it has been widely used in American literature, appears to be based on this third meaning, and follows an inaccurate spelling of the word "corrosion."

Penck § treats corrosion and corrasion as a mere variation of spelling, and so apparently did Richthofen.‖ Nearly all British authorities have, for the same reason, ignored the latter word.

Corrasion as defined by Gilbert is exactly synonymous with denudation as defined by Lyell in 1841; and according to Gilbert's definition wind corrasion and even glacial corrasion are contradictions in terms, although adopted by some authors. Thus Russell rejects the restriction of corrasion to water-action. He defines corrasion as "the process of stream abrasion due to the friction of transported material and to chemical solution, as a part of the general process of land degradation." ¶ He therefore regards it as essentially a basal action, and says it "is carried on mainly by mechanical wear due to the friction of silt, sand, gravel, boulders, etc., carried through it by the flowing waters." ** Nevertheless, he does not regard running water as the essential agent, and speaks of glacial corrasion, æolian corrasion, and corrasion by waves and currents along the shore.

Corrosion and Solvent Processes.

Objection to the use of corrosion for the basal attack of any denuding agent on the ground over which it moves may also be raised from the tendency in recent American geographical literature to limit corrosion to chemical solution, as, for example, by Salisbury.†† The use of the word "corrosion" for etching and

* E. de Martonne, 'Traité de Géographie Physique,' p. 654. Paris: 1909.

† S. Günther, *op. cit.*, p. 889.

‡ Evorsion, a name due to E. Geinitz in 1886, is the wearing away of rock by pothole formation.

§ A. Penck, *op. cit.*, p. 245.

‖ Mr. C. D. Sherborn has kindly examined the first edition (1886) of the 'Führer,' and tells me that the spelling Corrasion is adopted there; in the 1901 reprint Korrosion is used in the text, and Korrasion in the index. Richthofen states in the preface to the reprint that he did not pass the proofs, so that it is doubtful whether the change of spelling was due to him or his editor.

¶ I. C. Russell, 'River Development as illustrated by the Rivers of North America,' p. 29. London: 1903.

** I. C. Russell, *op. cit.*, p. 29.

†† R. D. Salisbury, 'Physiography,' p. 129. 1907. Prof. Günther also adopts corrosive for solvent from its medical sense of chemical destruction of tissue ('Handbuch der Geophysik,' vol. 2, p. 889. 1899).

removal of tissue by a medical corrosive may appear to justify this use of the term; but the essential part of both those processes is not the solution, but the excavation or pitting of the material attacked. Hence Merrill's * description of rocks etched by solvents as "corroded surfaces" is fully justified.

The word "corrode" comes from the Latin *corrodere*, to gnaw away, which consists of *cor*, from *com*, the intensive prefix, and *rodere*, to gnaw. Its primary meaning as given in the Oxford Dictionary is "to eat into;" and it implies penetration into a body rather than the general gnawing away of the surface.

There seems no advantage in the limitation of the term "corrosion" to chemical action. The term "solution," used by Chamberlin and Salisbury in 1904,† is adequate and self-explanatory; there seems no need for a special term for rock solution as an agent in denudation. If there be, the introduction of a new term would be better than the misapplication of an old one; for the use of the term "corrosion" in physiography for the filing action of transported sediment seems etymologically more correct than for the chemical solution of rocks.

It may be objected that this paper looks upon scientific terms from an altogether impracticable standpoint, and that it is useless at the present day to attempt to limit the meaning of words by etymological considerations. I am quite prepared to follow well-established usage, even in those cases when a term is adopted in the exact opposite to its original meaning; but when there are alternative meanings in use it seems to me that the etymological test is of value; for the closer a term agrees with its strict interpretation, the less excuse is there for its being misunderstood.

It will be unfortunate if the important geographical terms considered in this paper should come to have different meanings in Europe and America, and I have submitted this statement as to their diverging use in the hope that it may lead to some more general agreement.

It seems to me convenient, in the mean time, to use the terms as follows:—

denudation for the wearing down of the land by any agency;
erosion for the widespread lowering of the land by wind, rain, and weather and by rivers and glaciers acting laterally;
corrosion for the excavation by rivers and glaciers of their beds;
corrasion dismiss as a synonym of corrosion;
abrasion for the attack of the sea on the land, though when used in this restricted sense it is well to refer to the process as marine abrasion;
solution for the action of solvents.

THE SURVEY OF THE HIMALAYA.

By Dr. T. G. LONGSTAFF.

The publication of Synoptical Volume XXXV. by the Trigonometrical Survey of India will be welcomed by many students of Himalayan problems, for much information is thereby made conveniently accessible which formerly could only be gathered piecemeal from scattered annual reports.

* G. P. Merill, 'A Treatise on Rocks, Rock-Weathering, and Soils,' p. 250, pl. 16 (not 17, as in text). 1897.

† T. C. Chamberlin and R. D. Salisbury, 'Geology,' vol. 1, p. 116. 1904.

This volume, the North-East Longitudinal Series, covers the Central Himalaya from longitude 78° to 88°. It also includes those peaks situated between longitude 88° and 92°, which were observed from stations in the North-East Series, but which properly belong to the Assam Longitudinal Series, as yet unpublished in this form. The long delay, almost inevitable under the circumstances, which occurs between work in the field and final publication of the results, probably accounts for the scant recognition by geographers and travellers of the labours of the Indian Survey in the Himalayan region. This delay is particularly regrettable in the case of the important survey operations so successfully carried out in connection with the recent mission to Tibet.

The present volume deals with the Himalayan region from Simla to Punakha, filling the gap between Volume VII. of the North-West Series, which covers Kashmir and the adjacent regions, and Volume XXII. of the Assam Valley Triangulation. The computation and classification of the data have been superintended by Mr. J. Eccles, M.A., and during his absence by Captain H. H. Turner, R.E. The preface is written by Colonel S. G. Burrard, R.E., F.R.S., and deals with some novel problems of great interest. Mr. H. G. Shaw's series of observations during the last four years are passed under review. They prove conclusively that refraction is greater in autumn than in spring; but they also indicate that there must be some other cause, besides differences in refraction, which produces discrepancies in the altitudes obtained for the same peak from different stations. The height of Trisul is discussed by way of indicating the difficulties of determining the actual height of any high mountain. The value 23,406 feet is found on both the official maps of Kumaon and British Garhwal (1872–75), and was obtained by the survey officer, Colonel Carter, from a small secondary series of triangulation which he carried through Kumaon and Garhwal. The height of the peak is given differently on the map and in the book, for individual observers have had different ideas about refraction and other corrections. When once the data have been handled and published, the preliminary values entered upon the maps are to be considered as cancelled. The writer has seen no explanation of the fact that heights on the maps are usually higher than those in the books. The value 23,360 feet, now officially accepted, was derived from observations of the peak obtained between 1841 and 1850 from distances of 29 to 84 miles. They vary from 23,441 to 23,280 feet, and the true height is taken as between 23,350 and 23,380 feet. Even here we have a further element of uncertainty, for it has been stated that when in future we come to correct heights for the disturbances produced by Himalayan attraction in the levels of theodolites, we shall probably have to add 60 or 70 feet to the values now accepted. In the present volume Colonel Burrard points out that gravity also causes the datum-level surface to be heaped up under the mountains, so that we are in doubt what surface we are measuring the heights of peaks from, for in trigonometrical operations we assume the

surface of the spheroid to be our datum, and in spirit-levelling we measure from the surface of the geoid. In the present state of our knowledge it certainly seems wiser to follow Colonel Burrard and ignore this additional complexity.

These volumes are indispensable to travellers undertaking any fresh topographical explorations of these regions, for they give the officially accepted height and position of the great Himalayan peaks and also full data from which can be ascertained the precise degrees of accuracy with which these have been determined. In the "degree charts," published in a separate volume, all peaks and stations have been plotted by Messrs. W. M. Kelly and J. H. Nichol, on a scale of 1 inch to 4 miles. This is particularly useful, as some of them are not shown on the topographical sheets of the Indian Atlas. An excellent innovation is the labelling of all peaks with a letter and two numbers by which they may be at once referred to their proper degree-square and identified without possibility of error.

The introduction by Captain H. H. Turner, R.E., deals firstly with the main triangulation carried through the fever-haunted Tarai between 1841 1851, and then with the topographical survey of Kumaun and Garhwal from 1864 to 1877, and the Sikkim survey of 1878 to 1885. The second portion contains a few scanty references to various ascents by the indefatigable officers of the survey, which mountaineers will regret are not given in much greater detail. Some additional information can, however, be obtained from the Annual General Reports of the Survey of India.

During the previous operations in Kashmir and the adjacent districts, the officers of the Survey showed repeatedly that the physical obstacles of such a country were powerless to defeat them in the execution of their duty. They set up their theodolites on 10 stations of over 20,000 feet; they visited 20 other stations of over 20,000 feet and 5 of over 21,000 feet. By far the greater number of these ascents were in Ladak, and none of them presented such difficulties as the Nela peak, 19,069 feet, in Bashahr which was successfully ascended on June 22, 1854, by W. H. Johnson with a 12-inch theodolite. This peak had baffled the surveyors for two seasons and had defeated three previous parties. But the officers of the Survey of India lay no emphasis in their reports on achievements so remarkable, achievements each one of which would be enough to send many a modern traveller headlong to his publishers. As an instance of this, I may mention the case of the peak Shilla 23,050 feet, shown as a station on p. 259 of Volume VII. This peak is shown on Atlas Sheet 46 as "Parangla No. 2 Station 23,064 feet." On reference to headquarters at Dehra Dun I was furnished with the following particulars: It was observed from two stations, each of which was above 20,000 feet. When it was being observed the observer intended to visit it and to observe from it. But he never carried out this intention. It was visited by native Khalassis, who erected a staff. The name was changed to Shilla in the office at Dehra Dun.

When in the present volume we meet again with the names of such

officers as Carter, Thuillier (now Sir Henry R. Thuillier, K.C.I.E.), and foremost of all Montgomerie, supported by such tried mountain surveyors as W. H. Johnson, W. G. Beverley, E. C. Ryall, and others, we may expect to find some reference to mountaineering achievements comparable to those already accomplished in Kashmir. It should be remembered, however, that General Walker had, in the present instance, instructed the Topographical officers not to attempt accurate surveys above 16,000 feet, the department not being in a position to afford the cost in time and money. Hence areas of perpetual snow were occasionally mapped from sketches made from considerable distances, and much less climbing of high peaks was attempted. Many stations, however, were established at over 17,000 feet in Kumaon and Garhwal, and a few at over 18,000 feet, while along the borders of Hundes three peaks of over 19,000 feet were utilized. In 1874 in the Upper Mana valley the *average* height of Mr. I. S. Pocock's plane-table stations was 19,500 feet and his maximum height visited was 22,040 feet, this being so far the highest authenticated plane-table station in the Indian Survey.

Ryall's successful survey of a large part of Hundes is merely referred to. His own brief account was published in the General Report for 1877–78. Ryall and Kinney's map is, for much of the country, still the best which has ever been produced of this most interesting corner of Tibet. The Introduction includes a brief account of Captain H. J. Harman's survey of Sikkim in 1879. His feet were badly frostbitten on the Donkia pass (18,100 feet), and although he continued his work for three and a half months and in 1881 made an attempt to reach the neighbourhood of Kinchinjunga, he was obliged to take leave in November, 1882, and died early in the following year, having never completely recovered.

In the course of these several operations the surveyors, in addition to the privations inseparable from such work, suffered much from fever, to which several of them actually succumbed. Captain Basevi died at his post in 1871 on the exposed plains of Lanak. Dr. Stoliczka, of the Geological Survey, died on his way back to Leh in 1874, while in 1878 of the members of this branch 34 per cent. died or were incapacitated! The great Montgomerie died at the early age of forty-eight, his death being generally attributed to his long and severe service in the Himalaya.

It is to the arduous, conscientious, and unadvertised labours of these surveyors that both mountain climbers and explorers of these regions owe, and must continue to owe, a great debt of gratitude. The delineation in the Indian Atlas of topographical details in the regions of ice and snow is admittedly imperfect. The accuracy of maps is merely a question of degree, for no ordinary scale map can possibly be free from error; but it should be remembered that there is no other mountain region of the world at all comparable in extent to the northern frontiers of India, the physical features of which have been laid down with any approach to such a degree of accuracy.

REVIEWS.

EUROPE.

The Greeks and their Habitat.

'Greek Lands and the Greek People.' By J. L. Myres. Pp. 32. Oxford: Clarendon Press. 1910. 1*s.* 6*d. net.*

Prof. Myres has inaugurated the Wykeham Chair of Ancient History with a lecture which—happy omen!—is a contribution to geography as much as to history; and it may be taken as a sign that he will try to lead historical study in Oxford into fields as yet new to it—fields to which Major Ronald Ross, Mr. Jones, and Mr. Ellsworth Huntington have already pointed the way. He directs the attention of students also to another field, more familiar, but still only tentatively explored, that of physical anthropology. The lecture gives a brilliant and masterly sketch of the way in which economic geography and physical anthropology may be used to increase our understanding of early history, and it will be found eminently suggestive by those who have to deal with the records of many other lands and peoples beside the Greek.

Prof. Myres sets out to show the main strata, three in number, of which the historic Greek "race" was composed, and the geographical conditions which, on the one hand, determined the social system of each of the three elements in their original homes, and, on the other hand, account for features which survived in the social system of their land of adoption, the Greek peninsula. These features, however, he holds, accidental survivals, the essential characteristics of the Greek social type being determined by the environment of the Greek land itself, and therefore persistent, despite all immigrations.

The Hellenic "race" is the product of these conditions, and like all races, ought not to be regarded as determined primarily by blood. The modern Greek is as much a Hellene, on this reading of the word race, as any of his predecessors. Prof. Myres thus adds his voice to others which have been raised of late (*e.g.* by Petrie, Lang, and Mosso) against a vulgar fallacy in the connotation of "race," a word which, it must be admitted, has always been used so vaguely as to be of little or no help. The lecture is packed with clever phrases, and it will be a dull reader who is not set thinking by it. The modern Greeks will hail it as the most powerful justification of their Hellenic claim yet published; but they will meet in its pages with a disheartening prophecy of the economic future of their land—a prophecy forced on the author by the logic of his geographical argument. We have often admired the fertility of Prof. Myres' mind, but never more than in reading this lecture.

D. G. H.

'Cambridge County Geographies.' (Cambridge University Press, 1910. *Maps and Illustrations.* 1*s.* 6*d.*) 'Cumberland.' By J. E. Marr. (Pp. xii., 169.) 'Nottinghamshire.' By H. H. Swinnerton. (Pp. xii., 153.) 'Lanarkshire.' By F. Mort. (Pp. viii., 168.) In these later volumes of the Cambridge County series a certain elasticity is to be observed, which is wanting in earlier volumes; certain stereotyped explanations and one or two stock illustrations are missed with some relief. But the general system and form are not given up. There are, however, certain special points of interest, such as the maps which illustrate, in Nottinghamshire, the relationship between the geology on the one hand and the hydrographic system and the distribution of deep wells and of towns and

villages on the other. In Lanarkshire, again, maps show a beautiful example of the analogy between relief of the land and density of population in its simplest form. The illustrations in the same volume are particularly well chosen to illustrate every interest of the county.

'Climbing in the Ogwen District.' By J. M. Archer Thomson. (London: Arnold. 1910. Pp. xx., 124. *Diagrams and Illustrations.* 5*s.*) A clearly written and beautifully illustrated little volume by a pioneer climber who knows every inch of his district—a phrase justifiable in this connection.

'Guides-Joanne.' (Paris: Hachette. 1910.) 'Normandie.' By P. Joanne. (Pp. 456, 152. *Maps.* 7 *fr.* 50). 'Suisse.' By P. Joanne. (Pp. 380, *Maps.* 7 *fr.* 50.) 'Le Havre.' (Pp. 43, 152. *Plans and Illustrations.* 1 *fr.*) 'Lourdes.' (Pp. 32, 152. *Plans and Illustrations.* 0 *fr.* 50.) The large volumes follow the usual form of this well-known series. A notable feature of the Swiss guide is the very large number of the maps, which in view of the price of the volume disarms criticism of the rather rough printing. The smaller volumes (the second and longer category of whose pages is mainly occupied by advertisements) contain illustrations, and their information is highly detailed.

'Hungary.' Edited by Albert Kain. (Budapest: Erdélyi. 1910. Pp. 400 *Illustrations.* £2 10*s.*) This large and heavy volume, full of illustrations of Hungarian scenery and features of the principal towns, has been issued by the Hungarian State Railways, and published by order of the Minister of Commerce. It is sumptuously produced, finely illustrated, and full of information. An English proof-reader would find some work to do.

'Von Rügen bis Lappland.' By H. Beerli. (St. Gallen: Fehr'sche Buchhandlung. 1910. Pp. 124. *Illustrations.* 3 *m.* 50.) A simple narrative of a journey through Sweden from south to north, along recognized tourist routes—the Göta canal, Dalecarlia, Jämtland, and the northern railway by Gellivara to Narvik on the Ofoten fjord. The book has no distinctive feature, but is well produced and fairly illustrated.

ASIA.

PERSIA.

'The Glory of the Shia World.' By Major P. M. Sykes and Ahmad Din Khan. *Illustrated.* Pp. xiv. + 277. London: Macmillan. 1910. 10*s. net.*

Fellows of the Royal Geographical Society, who have listened to Major Sykes, and looked at his admirable photographs, will be glad to renew their acquaintance with his experiences in this pseudo-autobiography of one Nurullah Khan. They can follow him again to Kerman, Bam, Jiruft, Yezd, the Lut, and Meshed, with much pleasant entertainment by the way in the shape of anecdote relevant and irrelevant, citations from Persian authors, and humourous, half ironical, but always faithful descriptions of life and customs. Major Sykes has been greatly daring—perhaps he is hardly conscious how greatly he has dared—in challenging direct comparison with Morier's "Haji Baba," whom he represents as the grandfather of his Nurullah. But we have to judge his book here, not from the literary, but the geographical point of view, and, so regarded, we give it hearty welcome. If Major Sykes and Prof. Browne between them have told us too much of Kerman already to leave any novelty for this book, none has told us so much of the holy places at Meshed and the ceremonies of the pilgrimage as Nurullah does; and there is much detail in the social descriptions, especially those of marriage and funeral customs, which is new to us. The illustrations, though hardly illustrative of the text, are things of beauty and joy.

D. G. H.

Northern Sumatra.

'Nord Sumatra. Bericht über eine im Auftrage der Humboldt-Stiftung der Königlich Preussischen Akademie der Wissenschaften zu Berlin in den Jahren 1904–1906 ausgeführte Forschungsreise. Von Prof. Dr. Wilhelm Volz. Band I. Die Batakländer. Berlin: D. Reimer. 1909. 18*m*.

Dr. Volz's 'North Sumatra' treats of what has long been the least-known region of that, from many points of view, most interesting as well as most beautiful island of the Indian archipelago. Having been, as he tells us, impressed, during previous visits to the archipelago in 1897–8 and 1900–1, with the fact that a knowledge of the geological structure of Sumatra was the key to that of the whole group, he resolved to attempt the exploration of the Batak and Gajo districts. This work he was enabled to undertake in 1904 through the grant made to him of the Humboldt bequest by the Royal Prussian Academy of Sciences. The fact that it was considered expedient, although as events showed it was not absolutely necessary, that the traveller should be provided, as he was through the helpful consideration of the Netherlands Government, with an escort of an officer and forty men, bears witness that the exploration of this district—so long closed through the hostility of its independent tribes, from among whom cannibalism has not entirely vanished—cannot yet be undertaken without considerable risk. The book now before us, the first instalment of the results of Dr. Volz's researches, is devoted to the Batak-lands; a further volume, promised this year, will treat of the Gajo-lands, including the Allas and Atjin regions. The Batak-lands include almost the whole territory between the west coast plains of upper Sinkel and the east coast lowlands as far as Padang Lawas. The volume is divided into two parts: the narrative of the journey, and the scientific results. Dr. Volz's itinerary, transcribed from his daily journal, bears witness to the minute and systematic examination he made of the region. His special interest lay, as might be expected from a pupil of von Richthofen (to whom the work is dedicated), in its geological features, and particularly in its mountain structure and volcanic phenomena. In following the explorer's footsteps from day to day up the heights and along the valleys, we acquire quite a vivid picture—very interestingly described—of the conformation of the country and of the characteristics of its different villages. A beautiful topographical map illustrates the itinerary. It is based on 5000 compass bearings taken from 200 stations, on 500 trigonometrical measurements and 1000 barometrical readings, as well as on numerous landscape sketches and photographs. These Dr. Volz has had carefully incorporated with such trustworthy material as was already in existence, so that we may accept his map with much confidence as the most accurate delineation we have of this part of Sumatra. The second section of the volume discusses in fuller detail, in separate chapters beginning with the fifth, the author's geological, geographical, ethnographical, and other observations—for Dr. Volz did not by any means confine himself to his own special science. It traces the geological upbuilding of the Batak-lands from their pre-Cambrian floor of much-folded gneiss, mica-schists (Glimmerschiefer), and what is termed the "Malayan formation," through pre-Carboniferous times when granites intruded into the core of the surrounding chains, and during which long periods of elevation alternated with short subsidences; through the Cretaceous, when north-south and east-west dislocations, although attended by marked volcanic phenomena, produced but little tectonic results; through the earlier Tertiary, when the submergence of the greater part of Sumatra resulted in the filling up of its valleys with conglomerates and sandstones, and was attended with vast outflows of andesitic lavas rising into

mountain chains, a period during which the island became once more united to the Asiatic continent, from which still later eruptions again isolated it; through early and mid-Quaternary times, when prodigious outbursts of quartz-trachitic andesite lavas, issuing through huge longitudinal and transverse fractures—in the cross-cleft of two of which lies the Toba lake—buried the whole country. Since then the violence of these subterranean phenomena has slowly died down; tropical sun and rain have remodelled the face of the island into its present geographical features (chapters vi. and vii.), which have had an important bearing on the settlement and colonization of the region (chapter viii.). A most interesting chapter (ix.) discusses the history of the development of the Batakers: their original home and wanderings; the peculiarities differentiating the Karo, Pakpak, Toba, and Timor stems, in regard to house architecture, village arrangements, art in carving and gable-painting, and to their cannibalistic and totemistic customs. Herein are many interesting suggestions—which space does not permit us to do more than refer to—of real or apparent connection with the Papuasian region. Volz's final chapter deals with the future development of the Batak-landers, which has been retarded for ages through their never-ending intertribal wars and by the almost endemic prevalence of small-pox. An appendix contains a dissertation on the music of the Batakers by Herr Richard Heintze. More than a score of excellent full-page plates from photographs and 120 process blocks embellish the book. It contains, also, besides the topographical chart already alluded to, two maps—one of the geological formations, and the second showing the distribution of the forest and cultivated areas of the region. 'North Sumatra' will repay careful study by all geologists, geographers, and ethnologists interested in the Indo-Malayan region.

H. O. F.

'A Guide-book for Tourists in Japan.' By The Welcome Society of Japan. (Tokyo Chamber of Commerce. 1910. Pp. liii., 253. *Maps and Illustrations.* 75 *sen.*) This guide is well produced and laid out on useful lines—so much so that it is a pity that a thorough knowledge of the English language was not brought to bear upon its revision. If within its compass it can only touch the fringe of the many interests of Japan, it gives exactly the right information as to conditions of travel and accommodation, and indicates the most profitable method of using time on a shorter or longer stay in the country.

'L'Indo-Chine Française.' By Captain Magnabal. (Paris: Fournier. 1910. Pp. 145. *Maps and Illustrations.*) Physical, political, and economic geography, together with a treatise on the military and marine organization of the territory, occupy the main divisions of this handbook. It is carefully arranged and paragraphed, and, while attempting no literary attraction, possesses all the attributes of a work of reference containing copious information in a small compass.

'Japan for a week (Britain for ever).' By A. M. Thompson. (London: Lane. 1911. Pp. xiii., 254. *Illustrations.*) This work is amusing in parts, informative at times, vivid not infrequently on scenic topics and the ordinary incidents of travel. It has to be read with the prefacing apology of the writer in mind, for his visit to Japan was short, and his matter is mostly slight. The bracketed part of the title doubtless refers to those chapters which refer to the German "menace" and other items of world-politics. Is the publisher's practice of post-dating supposed to be of value to posterity? It is of singularly little value to present readers.

AFRICA.

The Regions east of Lake Chad.

'Au Tchad. Trois ans chez les Senoussistes, les Ouaddaïens et les Kirdis.' By Captain Cornet. 2nd Edition. Paris: Librairie Plon. 1910. 4 *frs.*

Captain Cornet, of the French Colonial Infantry, spent three years, 1905–7, in the regions north and east of Lake Chad, taking part in expeditions into Wadai, Borku, and Ennedi. The geographical and the political results of these expeditions have already been made known, but in this volume the author adds much valuable additional information concerning this borderland between the Sahara and the Central Sudan. A large part of the book is a reprint from his journal. It shows the captain to be a keen and sympathetic observer of nature, and especially of mankind. There is so little authentic and easily accessible information concerning Borku and Ennedi, and of the earlier phases of the French penetration of the Central Sudan that his work is specially welcome. It enables the reader to get a just idea of the character of the country and of the mentality of its inhabitants. Moreover, the occupation of Borku by the French is a preliminary to the occupation of Tibesti, the most important of the still unknown regions of Africa—a subject on which Captain Cornet has instructive comments. The Senussi power he thought overrated, an opinion which subsequent events have seemed to confirm. The book contains some good illustrations and a couple of sketch-maps.

'Biskra, Sidi-Okba and the Desert.' By J. C. Hyam. (Algiers: Hyam. 1910. Pp. xii., 103. *Maps and Illustrations.*) Quite a useful handbook, "got up" according to rather a peculiar standard of taste. A fair outline map of Algeria contrasts favourably with some plans which need the microscope. The ease and rapidity of travel in Algeria so far as the railway extends is remarkable. These have only to be widely understood bring the holiday-maker in numbers to the many interests of the Saharan fringe.

'English-Amharic Vocabulary.' By C. H. Armbruster. (Cambridge: University Press. 1910. Pp. xxviii., 504. 15*s.*) We quote the title on the cover, as more closely describing the volume than does the 'Initia Amharica' of the title-page. The latter is applied to the whole series of three volumes, of which the present is the second; the first was a grammar, the third will be an Amharic-English vocabulary. The present volume contains a quotation from the first on phonology, which serves as an introduction to the long series of signs necessary to the extremely difficult task of rendering the pronunciation of Amharic in our script.

AMERICA.

The Negro Question.

'The Negro in the New World.' By Sir Harry H. Johnston. With 390 Illustrations, chiefly by the Author, and several maps by Mr. J. W. Addison, R.G.S. London: Methuen. 1910. 21*s. net.*

Despite its comprehensive character, the title of this remarkable monograph on the negro problem in the New World scarcely does justice to the subject, and, indeed, is far from covering the whole ground. Apart from a marked bias in favour of the black populations the treatment of the question as a whole may be taken as fairly adequate from the historic, social, and economic points of view. In fact nothing could be more satisfactory than the vivid picture here drawn of the historic and social conditions, for instance, in Cuba, Hispaniola, and Brazil.

Thus we read that in Brazil "quite a million of the Amerindians are still pagan; twenty or thirty thousand of the negroes are muhammadan (more or less), or actually preserve their fetishistic beliefs brought from Africa. These pagan negroes have fetish temples in their villages, in which they house the rude figures of gods, similar to those of Dahomé and the Niger delta. I have seen a collection made in Brazil of these wooden painted idols which might have come from the west coast of Africa."

Here it is desirable to recall the statement made elsewhere and now repeated, that the negro "is a fine animal, but in his wild state exhibits a stunted mind and a dull content with his surroundings, which induces mental stagnation, cessation of all upward progress, and even a retrogression towards the brute. In some respects the tendency of the negro for several centuries past has been an actual retrograde one. As we come to read the unwritten history of Africa by researches into languages, manners, customs, traditions, we seem to see a backward rather than a forward movement going on for some thousand years past, a return towards the savage, and even the brute. I can believe it possible that had tropical Africa been more isolated from contact with the rest of the world, and cut off from immigration of the Arab and the European, the purely negro races, left to themselves, so far from advancing towards a higher type of humanity, might have actually reverted by degrees to a type no longer human."

In the face of these views it is difficult to understand how Sir Harry can now pit G. W. Gordon of Morant Bay notoriety against Governor Eyre during the Jamaica troubles of 1865. Much more consonant with them are the remarks of Governor Vardaman of Mississippi that "education is a curse to the negro race in America; that time has shown that he is more criminal as a free man than he was as a slave; and that he is increasing in criminality with frightful rapidity, being one-third more criminal in 1890 than he was in 1880, while official statistics showed that the most illiterate negroes were the least criminal." This seems to strike at the very foundation of Sir Harry's views.

The present population (p. 483) of the negroes and negroids in the New World is estimated at 24,591,000, including some ten millions of mestizos, or hybrids, with white peoples. This appears to be regarded as somewhat of a discovery, being considerably in excess of all previous calculations. Here the remarks are not very clear, but such appears to be the general inference. In any case the figures advanced from time to time by the present writer have ranged from about twenty to thirty millions (*Encyclopædia Britannica, Ethnology, "Man Past and Present," and elsewhere*).

The distribution of these figures appears to be approximately correct, some ten millions being assigned to the United States, nearly three millions to Hispaniola, over eight millions to Brazil, nearly six millions to the West Indies, and upwards of three hundred thousand to the Guianas and other parts of South America. Sir Harry deserves much credit for the trouble he had taken to elucidate this thorny subject, and his general conclusions may be accepted as fairly accurate.

There are several misprints or oversights which will require careful supervision in future editions which cannot fail to be called for. Thus the white man's invasion of Africa is dated back to 12,000 B.C., *ad majorem gloriam Dei*, where *Dei* is transposed; *huic* for *hujus* in *et huic generis omnes*.

A. H. KEANE.

'The Conservation of Natural Resources in the United States.' By C. R. Van Hise. (New York: Macmillan Co. 1910. Pp. xiv., 413. *Diagrams and*

Illustrations. 8*s.* 6*d.*) Every department of economic conservation—even human—is treated here, and the student of economic geography will find much in a small space to interest him. Minerals, water and irrigation, forests, and "the land" (*i.e.* agricultural products) are the subjects of the four main divisions of the book. In the part last named the land is classified according to the eight great natural regions of the United States territory. The book is based on a series of lectures, and is designed to present facts rather than to preach doctrines; perhaps it is the more useful on that account.

'Les Français au Brésil et en Floride.' By E. Guénin. (Paris: Bigot. 1910. Pp. 101.) This little work is in the nature of an essay on colonization. It is specifically directed against a school of French thought which holds that the French are not colonists by nature; one of those unsafe generalizations from a measure of half-truth. The story told in disproof of this theory is that of a little-trodden by-path of history, and slight as it is the volume shows evidence of careful research.

'Great cities in America.' By D. F. Wilcox. (New York: Macmillan Co. 1910. Pp. xi., 426. 5*s.*) This is a study of municipal government and its problems in Washington, New York, Chicago, Philadelphia, St. Louis, and Boston. The present conditions of government and the history of its development in these centres offer many peculiar contrasts, not only between one and another, but also between them all and the practices which obtain in this country, and the book should interest students of municipal affairs.

'Up the Orinoco and down the Magdalena.' By H. J. Mozans. (New York: Appleton. 1910. Pp. xiii., 439. *Maps and Illustrations.*) This volume is rather closely printed, and contains a larger amount of miscellaneous information than the usual travel-book. We pass from narrative to ethnology, history, botany, and many other subjects in rather bewildering sequence. The copious references to authorities, both early and modern, are a useful feature of the book. Of course, the route described is nowhere new, and strictly geographical detail has not greatly attracted the writer.

'Au Brésil de l'Uruguay au Rio São Francisco.' By P. Walle. (Paris: Guilmoto. 1910. Pp. xx., 440. *Maps and Illustrations.* 8 *fr.* 50 *c.*) This is a volume of information of encyclopædic character, whose utility is sadly diminished by the absence of an index. This want is partly obviated by systematic arrangement; the country is dealt with state by state, and for each the physical, administrative, and economic conditions are described on similar lines, the last being analyzed with care and detail, which make the book by no means light reading. The map is in part illegible.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Climate and Health.

'Deutsche Klimatik.' Dargestellt von Dr. Karl Dove und Dr. Frankenhäuser. *Tables and* 4 *Maps.* Size 9½ × 6½. Pp. 280. Berlin: D. Reimer. 1910. 8*m.*

This book outlines the system of air-cure for those in need of rest and for valetudinarians, and is designed for the use of medical men, geographers, and the proprietors of and visitors to spas, with especial reference to Germany. The first chapter opens with an account of the broad climatic divisions of the Earth, with their general effects upon the human body, and goes on to discuss the climatic elements, temperature, precipitation, wind, sunshine, etc., in relation to special districts. The second chapter deals with the effects of climate upon man, and the control which atmospheric conditions exert upon his bodily functions. In chapter iii., treating of the application of special climatic peculiarities in the

treatment of disease and describing typical cures, the authors point out that the beneficial effect of a change of climate will depend upon the stage to which the disease has advanced when a patient tries it. Thus the dry and excessive climate of South Africa is highly favourable to consumptive patients in the early stages of the disease, acting as a stimulant, but is rapidly fatal to persons in the advanced stage, on account of the great demands which such a climate makes upon the assimilative powers of the body, and the extra irritation caused to the lungs by the dryness of the air. In the first chapter (pp. 100–109), the highly interesting question of the influences of different types of scenery upon the health and enjoyment of patients is touched upon. The authors maintain that the nervous patient in search of rest or change should avoid the region of the high Alps as being oppressively shut in, and also, in some cases, too exciting, and betake himself to the outer spurs of the chain, where he will find open wooded slopes, quieter waters, and peaceful meadows. With this opinion we quite agree; for the scenery of the high Alps is overpowering in its sublime and savage grandeur, and the sense of the mystery, power, and majesty of the mountains may lead to a condition of mental excitement liable to act prejudicially upon imaginative or thoughtful patients. The suitability and attractiveness of the north German forest and heath-lands, like the Lüneburger heath, as a recuperating ground, are commented upon, and their bracing air and beautiful colourings extolled. In this connection we may note that the salubrious heath and pine country of western Surrey and northern Hampshire is much in favour for residence, and that Tyndall, the "discoverer" of the Hindhead uplands, proclaimed the air to be as tonic in effects as any to be enjoyed in Switzerland.

The fourth chapter of the book affords hints as to the choice of health resorts, and contains a list of German spas. There are four maps of Germany, in relation to the subject-matter of the text. L. C. W. B.

GENERAL.

Sir Woodbine Parish.

'A Life of Sir Woodbine Parish, K.C.H., F.R.S. (1796–1882).' By the Hon. Nina L. Kay Shuttleworth. London: Smith Elder. 1910.

A life of Sir Woodbine Parish should be welcome to Fellows of this Society, for he was an active member of our Council for nearly eighteen years, and twice Vice-President. All matters relating to South America were referred to him for a much longer period. Sir Woodbine's knowledge of South American history and geography was unequalled by any of his contemporaries, and he constantly gave us the benefit of his researches. Among other communications, it was Sir Woodbine who gave us the particulars of Spanish voyages in the Pacific in the eighteenth century, of the expedition of Gulielmo Cox across the Southern Andes, the account of the southern affluents of the Amazons from the manuscripts of Tadeus Haënke, a report on the river Beni, and a paper on the Falkland islands. His 'Buenos Ayres' is a classic among works of the kind, and still holds a foremost place after nearly sixty years. Our library also is indebted to Sir Woodbine's liberality, his most important gift being the '*Coleccion de obras y documentos de las provincias de Rio de la Plata*,' by Pedro de Angelis, in five volumes. Sir Woodbine retired from our Council in 1854, but for many years afterwards replies to references and other valuable communications came from Quarry House.

Geology is as much indebted to Sir Woodbine Parish as geography. He collected a mass of meteoric iron from the Chacu, and was indefatigable in his efforts to obtain complete skeletons of the great fossil mammals of the Plate regions, the glyptodon and megatherium.

To those who know only the scientific services of Sir Woodbine's long and ful life, the narrative of his earlier career and of his diplomatic labours will ve great interest. His granddaughter, Miss Nina Kay Shuttleworth, has per-med her task with ability and sound judgment, and has only inserted letters d despatches when they are necessary to explain or illustrate the story of an entful life. Woodbine Parish, when quite a youth, was employed in Sicily d Naples, in the department of the commissary-in-chief, and in the Ionian nds under Sir Thomas Maitland. The narrative including this period is ry interesting. Parish's next employment was as attaché to Lord Castle-gh at the Aix le Chapelle Congress and in Paris. The death of his master, en Lord Londonderry, found Parish acting as assistant Under-Secretary in the reign Office, an experienced diplomatist, highly thought of by his superiors.

Mr. Canning had succeeded Castlereagh, and resolved to recognize the inde-ndence of the South American Republics. He turned his attention to Argen-a in the first place, as the state which was first to become independent, and s likely to be the most important. He gave the appointment of Consul-General Sir Woodbine Parish in 1823, and supplied him with full instructions. Miss y Shuttleworth here furnishes a condensed but well-written *résumé* of the evious history of Buenos Aires, which enables the reader to understand the sition of affairs when Sir Woodbine arrived.

His diplomatic services at Buenos Aires must be considered the great work Sir Woodbine's life. Canning could not have found a better man to execute is difficult and very important mission. He became popular, was always mpathetic; and he successfully negotiated the first commercial treaty between eat Britain and a South American Republic. During ten years, from 1823 to 33, Sir Woodbine watched over the interests of his own country, while, at the me time, he established a very friendly and cordial feeling between the two untries. He was, as he himself wrote, "identified with the history of the dependence" of Argentina.

After his return from Buenos Aires Sir Woodbine was employed once, and at was on the very difficult question of the sulphur claims. He was sent to aples to assist Sir William Temple, and his work, which was successful, received ll appreciation.

The latter years of Sir Woodbine's life were passed at Quarry House, St. eonards, where he occupied himself in valuable literary work, where he was ngaged in attending to the interests of a large and attached family, and where e died at the age of eighty-seven.

The life-story of so distinguished a diplomatist and man of science is well orthy of detailed record, and the memory of Sir Woodbine Parish is ably pre-rved by his biographer. C. R. M.

Travel and Sport.

Hunting Camps in Wood and Wilderness.' By H. Hesketh Prichard, F.Z.S. London: W. Heinemann. 1910. 12*s. net.*

This is a description in full detail of a series of hunting expeditions in the idely separated regions of Norway, Canada, Newfoundland, Labrador, and atagonia. As some parts of the last three countries had not previously been isited by sportsmen, the narrative is of considerable interest.

In Patagonia the author is struck with the desolate landscape of the pampas, here herds of guanaco and wild cattle roam, as well as the puma, Patagonian are, and common grey fox. The rhea (locally called ostrich) also affords excel-ent sport, and it is described as the wildest and most difficult quarry. The

guanaco, another sporting quarry, is distributed over the whole area of the pampas; being very numerous, it is the "prop of life to the nomadic tribes" in the south, as is the caribou in the same latitude in the north. There are some interesting accounts of days spent on the pampas with the rifle alone, and also in the more exhilarating way of hunting (guanaco especially) with horse and hound. The Patagonian Indians hunt by forming in a large circle and driving the game inwards. Guanaco and rhea abound on the lower slopes of the Andes and on the adjacent levels, while higher in the mountain regions guemal (or huemal) and wild cattle have their home. The guemal, the beautiful deer peculiar to the Andes, was found to be more easy of approach if the hunter walked upright than if he attempted to get to close quarters by crawling. The puma is everywhere, but is more numerous on the rocky escarpments of the lower hills. These five species complete the list of big game in Patagonia. One feature of the Andean foothills is the extraordinary number of birds and beasts of prey that exist there.

Labrador (1903) is another virgin hunting ground, and it was found to be a wild, gloomy, and sterile country; five or six weeks were spent there without seeing either bear or caribou. 1903, however, was a bad year for caribou, for the ill-fated Hubbard expedition further south killed but one animal. A description of the marshy, moss-grown barren lands of Labrador is given, and their strong contrast to the arid plains of Patagonia in the same latitude south pointed out.

In Newfoundland (1903–6) the Government gave the author licence to kill extra caribou stags in recognition of his attempt to open up Labrador as a sporting field. The interior of the country is well described, and there is an account of a stag fight. Game was plentiful, and during one fortnight an average of a hundred caribou per day was seen, about ten per cent. being stags.

The hunting of the elk in Norway (1905) is compared unfavourably with that of the moose, the New World form of the same animal, in Canada. It was a poor season, for only two heads were secured after eighteen blank days.

The hunting of the moose, the greatest of deer, in Eastern Canada (1906–8) afforded excellent sport, but the use of the hound—not in packs, nor singly and loose, but on leash—would add enormously to the enjoyment of the hunter; but dogs in moose-hunting are prohibited all over America. The descriptions of moose "calling" are interesting, and moose "jacking" is an exciting sport attended by no small danger when the moose charges.

In order to correct the idea held by some people that big-game shooting is inseparable from great slaughter, the author states that during the trips he deals with he "fired on an average once for every six days' hunting."

Some excellent illustrations by Lady Helen Graham and Mr. E. S. Caldwell, and numerous photographs add much to the interest of the work.

W. B.

Map Projections.

'The Theory of Map-Projections, with Special Reference to the Projections used in the Survey Department.' By J. T. Craig, M.A., F.R.S.E. Cairo: National Printing Department. 1910. Pp. iv., 80.

Amongst the many important treatises issued by the Egyptian Survey Department, the one under review takes a high place. Mr. Craig is not only a master of the subject of map projections, but is himself the author of an original projection of a very interesting type. In the preface Mr. Craig remarks that his treatment of the subject is almost exclusively analytical, and, though this may be a stumbling-block to the beginner, it must be confessed that it is the only way in which the matter can be seriously dealt with. The attempt to treat projections geometrically absolutely fails. Indeed, the geometrical sound of the

word "projection" has before now led to curious misconceptions and mistakes. The word has, however, come to stay, as the author points out.

The title of the treatise sufficiently explains its scope. It is not, so to speak, an exhaustive account of the whole subject, and deals individually with but few projections. But it does contain a very general theory, which is an excellent foundation for all possible applications, and deals sufficiently with these applications for the particular purpose of the book.

Geographers who are not familiar with the calculus may be warned off. From the nature of the case the work is rather hard reading. It is, however, full of suggestive ideas, as, for instance, the working out of an equivalent polyconic. But the most original discussion is that which treats of the provision of a map which shall give the true bearing of Mecca at any point. For this Mr. Craig has invented a new class of projections which he terms the *retro-azimuthal*.

Some minor points may be noted. The author throughout uses the term "equivalent" in place of "equal area," and "conformal" in place of "orthomorphic." Opinions may reasonably differ as to the use of these alternative expressions. Perhaps Lambert is hardly given his due in the brief historical remarks. The projection approved for the International Map is not the "rectangular polyconic," but a slightly modified "simple polyconic." In his mention of works on the subject written in English, Mr. J. T. Craig omits to note the important 'Treatise on Projections,' by Mr. T. Craig of the U.S. Coast and Geodetic Survey.*

Mr. J. T. Craig is to be congratulated on his important contributions to the study of map-projections, the most important British contributions since the papers of Airy and Clarke.

C. F. Close.

THE MONTHLY RECORD.

EUROPE.

The Limit of the Olive in South-East France.—An interesting study of the northern limit of the cultivation of the olive in the south-east of France, between the Rhone and the Italian frontier, has lately been made by M. Raoul Blanchard, who, in presenting the results of his detailed examination of that limit on the ground (*La Géographie*, October and November, 1910), points out the special claims which the olive has to be considered the type-species of the Mediterranean climate and flora, its cultivation ceasing where these disappear. Besides clearly illustrating the subject by a map, the scale of which permits a far more precise definition of the limit than has been possible in previous inquiries of the kind, the writer follows the line step by step throughout its whole course, bringing out carefully the special topographic or other reasons for any deviations from the normal direction. In the light of the facts thus obtained, he concludes with a general discussion of the geographical significance of the limit, which he shows to occupy on the whole a fixed position in spite of temporary fluctuations. Soil certainly has no influence in the matter, for the line is seen to pass at haphazard across the most diverse formations. Nor is mere latitude the determining factor, for the limit runs at quite different latitudes at different parts of its course. It likewise is to a great extent independent of altitude, for, while ceasing to exist at certain parts as low as 100 metres, at others the olive may ascend to 700, 800, and even to nearly 900 metres. A favourable exposure on the other hand is

* Washington, 1882.

(given the general limits of latitude and altitude under which its growth is possible) evidently the prime factor in the case; suitable shelter against the winds from the north, north-east, or north-west, permitting it to considerably overstep the line at which it would otherwise be arrested. This demand for shelter is a consideration of too special a nature to permit us to regard the limit of the olive as a true dividing line for climate and vegetation. It is by no means exactly coincident with the limit of the Mediterranean flora, which, generally less dependent on shelter, can spread over exposed uplands where the olive finds no foothold. Nor does it coincide with the limit of the Mediterranean climate, determined by the seasonal distribution of the rainfall. Thus the rainfall region of eastern France extends in the Rhone valley south of the limit of the olive, while that of Mediterranean France passes elsewhere considerably to the north of the same limit.

Water-levels of Lake Werner.—This subject is dealt with by A. Wallén in the first number of a new series of publications issued by the Hydrographical Office at Stockholm ('Meddelanden från Hydrografiska Byran.' I. Stockholm: P. A. Norstedt. 1910). Lake Werner, with an area of 2150 square miles, is the largest lake of Europe after Ladoga and Onega. It is drained by the Göta river, which has a catchment basin of 18,720 square miles, and owing to the large volume of water required to raise its level appreciably, it exercises a regulating effect on the discharge of the river. At Sjötorp, the terminus of the Göta canal, observations have been recorded of the water-level for the past hundred years, and other series of less importance are available. It has seemed, then, to Dr. Wallén that an analysis of these observations will now be valuable both in scientific and practical interests, for the questions of the regulation of the Werner must before very long be seriously considered. Many investigations have been made in former times on the hydrography of the lake, of which an account is given here, with a bibliography. Dr. Wallén's analysis of the records has resulted in showing that besides the annual fluctuation, periods of 2 to 3 years, of 11 years, and perhaps of 40 years, exist. In handling the material the author has applied Schreiber's method of mean values of groups. For instance, he takes the means of groups of 12 monthly means—January to December, February to January, etc.—thus smoothing out the curve and eliminating the annual variation. The maxima and minima of the smoothed curve belong to periods of longer duration, and these are separated out by taking groups of 40 monthly means, of 132 months or 11 years, etc. Of especial interest is the 11-year period, as it is that of sunspots. The curves show two maxima and two minima within this period, and those of the height of the water and of the annual precipitations and temperature exhibit a close analogy, though it should be remarked that the phases of the precipitation are always a little anterior to those of the water-level, while those of the temperature curve are sometimes a little behind, sometimes a little in advance. The frequency and duration of the water-stand at different levels is also treated of, and the work is fully illustrated by twelve sheets of curves. A *résumé* in French is added.

Monte Amiata.—A memoir by Giotto Dainelli, constituting No. 12 (July, 1910) of the *Memorie Geografiche*, deals with the altimetric zones of Monte Amiata, being the second of a series devoted to a discussion of altitudinal distribution in Tuscany. It presents a general survey of the mountain, which rises 6000 feet above the sea, including its geology, morphology, vegetation, with the distribution of wine and other produce, and of population upon its flanks. The mountain is of volcanic origin, the core being composed of a mass of trachytic rock, which, forming the upper surface, overspreads and rests upon Eocene deposits forming the lower slopes. The vegetation zones of Monte Amiata are interesting. The

higher part down to about 3400 feet is covered with beech woods (*bosco di faggi*), the lower part with chestnut (*bosco di castagni*), the two zones being either in direct contact or separated where the mountain surface presents a terraced contour by an area of "heath" (*scopeti*), in which broom plants are the most characteristic. The lower limit of the chestnut woods is marked by the termination of the trachyte rock, whereas the upper limit is determined by altitudinal circumstances—that is, of course, by temperature conditions. This fact well emphasizes the importance of endeavouring to disentangle, as far as possible, the geological factor in correlating the distribution of vegetation in a country with climatic conditions. The density of population at the bottom of the mountain, some 1000 feet above sea-level, is only 6·3 per square kilometre, but it rises to 276·4 at an altitude of 2000 feet (an altogether inhospitable elevation in the British Isles), falling again to 1·9 at the top, some 6000 feet high as aforesaid. There are some very excellent photographs in this memoir, in one of which we catch a glimpse of Monte Amiata as seen from the south across a stretch of heathy landscape marked by clumps of apparently some species of pine, with their dark wavy plumes set in vivid contrast, one may imagine, against the dazzling radiance of Italian sun and sky.

ASIA.

Russian Explorations in Northern Siberia.—Reference was made in the *Journal* (vol. 33, p. 720) to the expedition sent out in 1909, under Mr. J. P. Tolmachef, for the examination of the Northern Siberian coast east of the Kolyma. At the same time a party under Mr. A. K. Volossovich was commissioned to carry out a similar exploration between the Kolyma and the Lena. Considerable difficulties were experienced, but both parties returned home after executing a careful survey of the coast and (in part) of the rivers debouching into that portion of the Arctic ocean. Tolmachef is said to have found that existing maps require extensive correction, and to have established the feasibility of opening a trade by sea between Bering Strait and the Kolyma. A nautical expedition for the further prosecution of the work is said to be in preparation (*Petermanns Mitteilungen*, December, 1910).

The Upper Yangtse and Yalong.—The November number of *La Géographie* (1910) contains the report of the paper by the Comte de Polignac on his examination of the upper Yangtse and its tributary the Yalong, to which reference was made in the *Journal* for December (p. 731). It is accompanied by a sketch-map, and adds some interesting details to those previously published. The valley of the Yalong is stated to be formed by a regular, north to south, fold of the ground, within which the river flows hemmed in by two chains of high mountains, composed mainly of eruptive rocks, schists, and sandstones. It presents the character of a large river, not, as might be supposed from the altitude of its bed and the nature of its valley, of a torrent. Its width reaches 250 yards, and, apart from the rapids, is rarely less than 100 yards. The narrowness of the valley makes it subject to sudden and violent floods, and gives it a fairly rapid current throughout. While generally resembling the rapids of the Yangtse, those of the Yalong form regular bars between which there are stretches of calm water, with but slight current. On this account, though its fall in the section examined is three times greater than that of the Yangtse, its mean rate of flow is less (about 5 miles an hour instead of 7). Owing to the broken nature of the country through which it flows, the upper Yangtse has, generally speaking, a torrential character, though there are tranquil stretches corresponding, according to the

traveller, to the positions of former lakes. With a current in general very violent, there are great differences at different parts, due to the sudden variations in the cross-section of the bed. Apart from the rapids, the maximum rate of flow observed was 16½ kilometres (about 10¼ miles) per hour, while in the rapids it sometimes reached 22 kilometres, or about 14 miles. The volume * of the Yangtse is reckoned to be 580 cubic metres (20,500 cubic feet), and that of the Yalong 470 cubic metres (16,600 cubic feet), but, away from the influence of the former, the Yalong would no doubt show a smaller amount. The natives, however, regard the Yalong as the main stream, though from the traces left by floods the Yangtse must show a decided superiority at high water. Besides the rapids, the artificial fish-weirs form a great hindrance to navigation. This is at present exceedingly difficult even for boats, but it would be no difficult matter to improve the bed of the river, and this section could then be navigated by native craft with as much ease and less danger than the stretch between Ichang and Chungking. The intermediate section, however, between Long-kai and Sui-fu (within which the valley preserves a general character of sterility and desolation), offers so many obstacles that its general utilization for river-transport of any kind is out of the question.

Photographs from Northern China.—The expedition sent by the Carnegie Institution of Washington in 1903–1904, in charge of Dr. Bailey Willis, for geological exploration in China, secured a number of large negatives of Chinese views representing the scenery, the geological conditions (particularly of loess landscapes) and also Chinese buildings, monuments, and people. The route of the expedition through the provinces of Chili, Shansi, and Shensi led through the loess district, and some remote mountain regions of great interest and scenic beauty. We are informed that this collection of photographs has been placed on file with the Smithsonian Institution, and that copies may be had for educational purposes by application to the secretary of the Smithsonian, and payment of the costs.

AFRICA.

The Western Desert of Egypt.—An interesting account of a journey through the western desert of Egypt, carried out for the purpose of a magnetic survey, is given by Mr. H. E. Hurst in the *Cairo Scientific Journal* for November, 1910. It does not appear that any of the ground covered was positively new, but in parts at least the routes were little frequented and the topographical and other notes may be useful as supplementing the accounts of previous travellers. The route led from Aswan south-west by Kurkur to Dunqul (almost on the tropic), and thence north-west and north by Nakhail to Beris and Kharga, whence a trip was made to Dakhla. The country between Kurkur and Dunqul (to which there is a gradual slope downwards), and still more that between the latter and Nakhail, is described as exceedingly monotonous and featureless, though on approaching Dunqul, the three-peaked ridge of Jebel Um Shargher, recalling Cader Idris in its shape, rose finely from the plain. Nakhail, of which a view is given, contains a few dom and date palms growing on sandhills, from which last the somewhat precarious water-supply seems to be derived. People and cultivation were first seen again, after three weeks' absence from both, at Dush, at the southern extremity of Kharga oasis. From Kharga to Dakhla the road was interesting, winding round the base of low hills. About halfway there is a large tract which looked suitable for agriculture, were immigration possible. Dakhla is more compact than Kharga, and

* Apparently at the time of the examination, which is stated to have been at low water.

the villages are more numerous. The people were hospitable and enlightened. Its dates now mostly go to the railhead at Kharga instead of by the Darb el Tawil to Assiut. Inquiries were made in reference to the desert routes from Dahkla, and it was stated that no direct route to Siwa or Kufra is possible on account of the sand-dunes. A travelled Bedawi from the Hejaz, staying with the representative of the Senussi, informed Mr. Hurst that it was possible to follow the Terfawi road that goes south from Mut (official centre of the oasis), but that it was in places obliterated. When followed by Captain Lyons for some distance it was well marked, but with no traces of recent usage. The permanence of tracks in the desert is remarkable (*e.g.* distinct traces of Dr. Hume's expedition of the year before were seen between Dunqul and Kharga), and the question arises whether the roads were once more used, or whether the well-marked roads were due to the persistence of tracks left by an occasional traveller. Rumours are current in Dakhla of an unknown oasis to the south-west called Zarzura, and its existence is not impossible. Mr. Hurst gives an interesting account of the method employed in Dakhla of dividing the day into thirty units called feet (agdam), for the purpose of allotting shares in the use of a well in the case of joint ownership. A man stands at the south end of a north and south line determined by the pole star, and the extremity of his shadow is marked on the ground. He then measures the perpendicular distance of this mark from the north and south line, using his feet as units. Each foot from 0 to 10 is reckoned at one foot of the day, while from 10 to 18 four feet, and from 18 to 30 six feet give the same measure, anything above 30 being reckoned as one foot. The method is of course very inaccurate, much depending on the ratio of the man's height to the length of his feet, while the error will vary with the season. Occasional reference is made to the animals and birds seen, which included foxes, jackals, gazelles, teal, snipe, quail, doves, pigeons, etc. There are not many spots suitable for snipe in Dakhla, some of those marked as marsh on Beadnell's map having apparently dried up or been drained.

Travels between Lake Rudolf and the Nile.—Major H. A. C. Darley has sent us an account of journeys made by him (in part, in company with Mr. Cowley) in the still imperfectly known tract between the upper Nile, Lake Rudolf, and Abyssinia. The first letter was written in June, 1908, soon after the first journey was completed, but was mislaid and not sent until last November, when a further account of Major Darley's travels was also sent. From Morongole (in about 3° 40′ N., 34° E., according to Gen. Macdonald's map published by the War Office; see also the East African Syndicate map, accompanying Mr. J. W. Brooke's paper, in the *Journal* for May, 1905) the travellers went north and west by Zulia to Dodinga and Musingok, finding the last-named district inhabited by the Toposans (? Toporan of Dr. Donaldson Smith's map, *Journal*, December, 1900), who have a bad name, but seem willing to be friendly with white men. A good level road, with water all the way, was found to lead from Musingok through a big gap between Mounts Boyer (Baya) and Rogo (probably the Harogo of previous travellers) to Logire, a district at the western end of the Latuka country, the natives of which are dangerous and treacherous, and are well armed. All the country thereabouts, east of the Nile, is virtually outside Government control. From Musingok a trip was made to the Kurono river (evidently the Karuno of the Syndicate map), but its further exploration had to be postponed, as the whole country during the rains is knee-deep in mud. The travellers therefore went by the Loriyo river to Moro Akipi (Laura and M. Agabi of Mr. Brooke) to Koroma (Corma), the people of which district had been wiped out by the Abyssinians. Descending the hills and crossing the Keibesh river (the Maurizio Sacchi of

Bòttego), they reached the Abyssinian post of Magi among the subject Shangallas. Hereabouts barley, wheat, oats, and potatoes grew well. From Musingok to Magi not a soul had been seen. The transport animals were lost here from tsetse, by which they had been bitten *en route*. Subsequent journeys, described in the later communication, took Major Darley from the headwaters of the Keibesh to Murrile and west to the junction of the Kurono and Zangieta, which together form the Pibor or western branch of the Sobat. This is in fact, Major Darley says, called Zangieta until close to the Baro. It rises in Dodinga close to the headwaters of the Loriyo and Oguelokur, and would thus seem to be identical with the southern Ruzi of Wellby, thought by him to belong to the basin of the Akobo.* The Pibor basin will thus extend south to about 4° N., or more than a degree south of the point to which it was traced (through a flooded plain) by Comyn (*Journal*, vol. 31, p. 304). Above the Kurono junction, however, it seems to be merely a dry river-bed for a great part of the year. It is possible to travel only after the first rains, the whole country becoming subsequently covered with deep mud, and grass as tall as a house. Major Darley had been obliged to make his way to Addis Ababa, but hoped to return to Magi and push on to Lado *viâ* Tereima and Toposa, afterwards making his way back across country to Machako's.

M. Chevalier's Researches in French West Africa.—M. Chevalier, whose latest mission in West Africa has been already referred to in the *Journal* (see especially vol. 34, p. 341), has lately returned to Paris with somewhat impaired health, after completing important studies on the botanical and other resources of the various French colonies from Senegal to Dahome. A summary of the general results obtained is given in the December number of *La Géographie* (p. 441). In French Guinea, where four months were spent, an important piece of work was done in the selection of a site for a botanical garden, intended for the study of indigenous vegetable products and for the encouragement of the introduction of exotic ones. After a visit to the source of the Niger the expedition entered the habitat of the kola-nut at Kissi, which is also favourable for coffee cultivation. Proceeding southwards, and studying the rubber-yielding plants in the forests along the Liberian frontier, M. Chevalier entered the more mountainous country containing, in Mount Nzo (6000 feet), the culminating summit of French West Africa. In the districts of Danane and Man (Ivory Coast hinterland), where tribes of cannibals were encountered, there are numerous domes of granite somewhat resembling the Charnockite of India. A species of wild olive was discovered in the mountains of this region. Altogether nine months were spent in the study of the forest and cultivated products of the Ivory Coast, which M. Chevalier considers to be the richest of the French possessions in natural resources. Dahome was next visited. South, the oil-palm and maize are the principal products; in the middle zone considerable progress is being made with the cultivation of native cotton; the northern parts are less promising. Other districts visited were Gurma, Mossi, and other parts within the bend and in the valley of the middle Niger. While Gurma is a steppe region covered with gum-acacias, Mossi is thickly peopled and intensively cultivated. Here too cotton-growing promises well. On the whole M. Chevalier recommends the extension of existing native cultivation, coupled with the exploitation of forest products, rather than the introduction of exotic crops.

* Wellby's northern Ruzi seems to be the Kurono, and will thus also belong to the system of the Pibor.

AMERICA.

Exploration of the Upper Paraná.—Several reports on explorations of the tributaries of the Paraná in the state of São Paulo have been already noticed in this *Journal* (vol. 35, p. 328, March, 1910). Another of the same series * since received describes the survey of that portion of the Paraná which flows from north-east to south-west, between the states of São Paulo and Matto Grosso. The work was carried out by two parties, which descended the Rio Tieté to the main stream. One of these, under Engineer Jorge Black Scorrar, ascended to the confluence of the Rio Grande and Rio Paranahyba, which, at an altitude of 987 feet, unite to form the Paraná. Between this point and the entry of the Tieté the river receives six tributaries on the São Paulo side, while numerous openings connected with lagoons and swamps were also observed. These are much less numerous on the Matto Grosso side, which is higher, but there are as many as thirteen tributaries. A short distance above the Tieté is the great cataract known as the Salto de Urubú-pungá. From the confluence of the Grande and Paranahyba to this point the slope is about one in 6000 (10½ inches to the mile) and there are continual rapids, but no actual falls. As the Salto is approached the river spreads out to over 1½ mile in width, and some of the water is drawn off along minor channels each with its own fall; but the greater portion forms a cataract half a mile wide, in which the river falls 30 feet, subsequently narrowing to a torrent which is in places only 230 feet in width. At ordinary times the discharge is nearly 100,000 cubic feet per second, and this must be much increased in flood-time, when the river is some 25 feet higher. Details of the geology are furnished by Engineer Guilherme Florence, who accompanied the party. The course of the river lies entirely in Botucatú sandstone, which is probably of Triassic age. It contains frequent interculations of a "porphyrite," which would seem to be more accurately described as a basalt or dolerite. The rocks of the Salto de Urubú-pungá consist of a single sheet of amygdaloidal "porphyrite." This is intersected by gorges, which follow a north-west and south-east direction, transverse to the course of the river, and recall the structure of the Victoria falls on the Zambezi. Rounded blocks occur in the river in which a brown sandstone is seen enveloping the igneous rocks, and others in which the opposite relation occurs. Senhor Florence returned overland by way of São José do Rio Preto and Tayuva. The whole district appeared to be occupied by the Botucatú sandstone, with little or no "porphyrite." The other party descended the Paraná from the mouth of the Tieté to that of the Paranapanema, which forms the boundary between the states of São Paulo and Paraná. This portion of the Paraná contains numerous islands, but is comparatively free from rapids, the slope being only 1 in 10,000, or about 6 inches in a mile. At its confluence with the Paranapanema it is still 787 feet above the sea. As far as the mouth of the Aguapehy the São Paulo bank continues low, but further down it is higher than that on the Matto Grosso side. A topographical survey was carried out by means of tacheometers and prismatic compasses, and checked by astronomical observations. Observations of the magnetic deviation were taken at different points, and it was found to vary from 2° 1′ to 0° 25′ W. Altitudes were determined by mercury and aneroid barometers, which showed maxima at noon and midnight, and minima at 6 a.m. and 6 p.m. Meteorological tables are appended. The report is illustrated by reproductions of

* 'Commissão Geographica e Geologica do Estado de S. Paulo. Exploracão do Rio Paraná.' 1906.

photographs and by maps, including a large-scale chart of the Urubú-pungá falls.

The Peru-Bolivian Boundary.—Following the example set by Bolivia, the Peruvian Government, through its minister in London, lately applied to the British Government for the loan of several British officers to carry out, on behalf of Peru, the demarcation of the newly accepted frontier with Bolivia. The request has been acceded to, and a party of officers, selected in accordance with the recommendations of this Society, set out early in January to take up the work of demarcation, which is expected to occupy three years. The head of the party is Colonel A. J. Woodroffe, R.E., who has already had considerable experience of boundary survey in East Africa, and he is assisted by Captain H. S. Toppin, Lieut. M. R. Nanson, and Lieut. C. G. Moores. Both Captain Toppin and Lieut. Nanson hold the Society's diploma in surveying.

Mr. Enock's 'Farthest West.'—In the notice of this book in the January number (p. 86), the name of the publisher has been wrongly given, owing to a printer's error. It should be "Mr. John Long."

AUSTRALASIA AND PACIFIC ISLANDS.

The German-Dutch Boundary Commission in New Guinea.—From a note in the twelfth number of *Petermanns Mitteilungen* for 1910, based chiefly on Dutch sources, we learn that during the ascent of the Kaiserin Augusta river, referred to in the December number of the *Journal* (p. 734), another party, under Captain Sachse, had pushed overland to an elevated plain beyond the water-parting and reached a new river flowing at an altitude of 720 metres (2350 feet). After flowing for a time south and breaking through the mountains, it took a westerly and even a north-westerly direction on the plateau, and it was followed for a long distance within Dutch territory without affording any view of mountains to the south. The eventual destination of this stream is difficult to conjecture. A telegram from Dr. Schultze (the leader of the German section of the Commission) announced, on December 17, the completion of the examination of the boundary, apparently after a second ascent of the Kaiserin Augusta river had been effected to within sight (in a westerly direction) of the central Snowy range. The position of the farthest point reached does not seem to differ much from that mentioned in the first account (*Journal, l.c.*).

POLAR REGIONS.

Tidal Results of the Shackleton Expedition.—Sir E. Shackleton's tidal observations were submitted for reduction to Sir George Darwin, who summarizes the results in the *Proceedings of the Royal Society* (Ser. A, December 15, 1910). The first section of the paper, by Mr. James Murray, describes the method of observation, the apparatus devised for the purpose being illustrated by diagrams. It was finally got into working order on July 14, 1908, and ran without mishap till nearly the end of October, when, the wire having been broken during a blizzard, it became necessary to discontinue the observations. In the second section, Sir G. Darwin explains the method of reduction, and gives a comparison between the new results and those obtained by the *Discovery*. After giving in tabular form the values of the various constants as obtained from the *Nimrod* and *Discovery* observations (in the latter case the results of a new reduction, correcting in some particulars the values originally obtained, are also given), Sir George points out that "the agreement between these two sets of constants, deduced from observations taken at places some 25 miles apart, seems to be very good. The later observations were taken further north than the earlier ones, and the greater value

of M_2 in the more northerly series is probably a reality," the semi-diurnal tides appearing to diminish in importance as we penetrate to the south. The new results do not, however, tend to confirm the truth of the seasonal change in the amplitude and phase of the tide M_2 (which seemed indicated by the *Discovery* observations), though they can hardly be held to invalidate it. The concluding section is occupied by a discussion of certain seiche-like oscillations of mean sea-level, which seem to be brought out by the observations. A diagram shows that the daily means of sea-level take a remarkable zigzag course, even when a correction for barometric pressure has been introduced. This correction, though sensibly diminishing the zigzags, does not annul them, while it introduces certain new maxima and minima which may have been annulled (in the actual observations) by distant barometric changes and gales. The oscillation thus indicated has an average period of about 3 days, and though this is far longer than appears to have been previously recorded in the case of sea-seiches, the suspected seiche of 45 hours on Lakes Michigan and Huron conjointly justifies the application of the theory of seiches to oscillations of long period. The probable occurrence of such a seiche in the Ross sea is of special interest in connection with the question of the form of the Antarctic lands. It seems likely, at any rate, that there is a bay extending back for a considerable distance behind the ice-barrier (which would probably not interfere with the long-period oscillations of the sea beneath it), and the formula gives some indication of the length and depth of the bay, on the supposition of a seiche with a period of three days. Sir G. Darwin finds that a bay stretching past the pole with a slight eastward trend as far as 80° S., with a depth of 100 to 150 fathoms, would oscillate with such a period, and says that the seiche would probably be much the same if the bay extended through to the Weddell sea, with a constriction where the end of the bay had been previously placed. He admits, however, that a good deal of uncertainty attaches to his conclusions, though a re-examination of Captain Scott's results seems to confirm the existence of the above seiche. Moreover, a similar examination of tidal records from the Indian ocean gave no such evidence of periodicity, except in the case of records from Karachi.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Proposed Atlas of Geomorphology.—In spite of the abundance of photographs in existence which might be useful as illustrating the forms of terrestrial relief, geographical teachers have hitherto suffered from the scattered nature of the material and the absence of an easily available collection of views, covering systematically the whole field of the subject. Prof. Emile Chaix of Geneva has for some years devoted himself, with a zeal for which all geographical students may well be grateful, to the task of arousing international interest in a project for the supply of this want. In 1907 he brought forward the matter both before the Geneva Geographical Society (in a paper printed in vol. 45 of the *Mémoires* of that body) and before the Helvetic Society of Natural Sciences at its meeting at Fribourg (*Actes*, 90e Session, Fribourg, 1907, vol. 1). Having secured the collaboration of Prof. F. Brunhes and some financial support from a resident in Geneva, he for a time entertained the idea of commencing the undertaking with the means then at his disposal. Subsequently he decided to appeal for support to the International Geographical Congress, and, conjointly with Prof. Brunhes, laid the matter before that body at its Geneva meeting in 1908. The result was the formal endorsement of the project by the Congress, and the appointment of a strong committee charged with the necessary measures for its execution. To a

sub-committee composed of MM. Chaix, Brunhes, and de Martonne, was entrusted the task of formulating a definite scheme. This has now been done, and is explained in a circular issued last summer (Lyon: Imprimerie Waltener). It is proposed that the photographs be published on separate plates of quarto size, each accompanied by a brief commentary; a map showing the precise point of view; and a section or diagrammatic representation of the ground such as is employed by Prof. W. M. Davis and others. The plates would be issued in sets classified either systematically or regionally. It is calculated that, in order to supply a sufficient representation of the chief forms of relief (according to a scheme printed with the circular), 500 to 600 plates would be necessary, but the number could be doubled or trebled if regional series were included. It would be desirable to fix the selling price at 1 franc the plate if taken separately, this being reduced by one-half if subscribed for in sets of 100. The scheme will be submitted for the approval of the approaching International Congress at Rome, but meanwhile, in order to form a preliminary idea of the receipts to be expected from subscriptions to sets (apart from possible subventions by Geographical Societies and other public bodies), those interested in the scheme are asked to state, on a form accompanying the circular, whether they would be disposed to subscribe for one or more sets of 100 plates. An experimental issue of two parts, containing about 20 plates, is contemplated by the committee, and geographers are asked to send in photographs according to instructions printed in the circular. Communications are to be addressed to one of the members of the Executive Committee named above.

Interdependence of the Weather of Widely Separated Regions.—The Earth's atmosphere, whose movements are initiated by inequalities of temperature established by the sun's rays, and developed by the rotational velocity of the Earth itself, must be so far regarded as an organic unity that its precise condition at any particular point of time over any given area has some connection, whether apparent or not, with the simultaneous condition over any other given area, in such a way that any change taking place, say, over England, must entail some modification, say in Australia, although the latter change might not necessarily be apparent to ordinary observation, nor, in the vast majority of instances, could its nature or extent, in our present ignorance of the laws which govern the atmosphere, be predicted. The future of meteorology, indeed, would seem to depend very largely on our being able to analyze what observations are available with the object of detecting this co-relationship between atmospheric conditions over diverse parts of the world. Mr. J. I. Craig, of the Egyptian Service, has pursued this line of investigation in a paper published in the *Quarterly Journal of the Royal Meteorological Society* for October, 1910. The title of the paper is "England —Abyssinia—The South Atlantic; A Meteorological Triangle," and in it the author succeeds in bringing to light the probability of a connection between certain meteorological elements in the three regions named. Dr. Shaw had previously revealed the likelihood of a connection based on certain correspondences between the intensity of summer rainfall in the south of England and the strength of the south-east trade wind at St. Helena, and Mr. Craig endeavours to show that the connecting-link, if it really exists, may be so simple a one as the direct passage of a current of air from the South Atlantic to England. So much for one side of the triangle. The author then shows that the rainfall of the Abyssinian plateau, which is alone responsible for the Nile flood, is supplied by moisture from the south Atlantic, not from the Indian ocean, as is often held, and that part of the south-east trade in the Atlantic is thus diverted to the right across the interior of Africa. The coefficient of correlation adduced for pressure and wind conditions at St.

Helena and the intensity of the Nile flood is as high as 0·605 with a probable error of ±0·106, and " indicates a close and probably real connection between the variants." The general conclusion arrived at is that as regards the South Atlantic and Abyssinia a good case exists, but that as regards the relationship with England the results are suggestive rather than conclusive.

Temperature and Trade Winds in the North Atlantic.—Commander M. W. Hepworth, C.B., has discussed this subject in a recent official publication of the Meteorological Office (M.O. 203). The study is based on surface temperature observations relating to the portion of the North Atlantic north of the 30th parallel, and the distribution of temperature during each month of the five years 1903–1907 is carefully followed with a view to ascertain, by comparison with average results, what departures from the normal have taken place in this period. Close comparison of the variations occurring in the distribution of North Atlantic surface temperature with the variation in the strength of the trade winds in both hemispheres, affords evidence that a relation subsists, although it may sometimes be masked by other causes affecting the temperature of the Atlantic, between departures from the average in the velocities of the north-east and south-east trades in any particular year, and deviations from the normal in the distribution of North Atlantic surface temperature in the following year. Thus the two phenomena trade wind and temperature distribution in an area over which neither the north-east nor south-east trade blows, apparently unconnected, are found to be linked—not, of course, in the relation of cause and effect, but in the common expression of an underlying cause or chain of causes; and it is, unfortunately, in this painfully laborious process of ascertaining how any two, three, or more among diverse complicated groups of elements are co-related that we find the richest and most promising field of meteorological inquiry. In the North Atlantic there are two belts or zones in which some of the most important changes of temperature take place, one lying between Florida strait and the south-west coast of Ireland, dominated mainly by the influence of the Gulf Stream, and the other between Florida strait and Cape Race, in which the temperature is as much influenced by the Labrador Current as by the Gulf Stream. A chart showing by isothermal lines the mean annual surface temperature of the North Atlantic ocean indicates a temperature about 80° Fahr. between the equator and 20° N., decreasing with moderate regularity to about 64° Fahr. in lat. 40° N., above which parallel the anomalous distribution due to currents is established, so that while the Gulf Stream Drift warms the water up to 54° Fahr. along the north-west of France and south-west of Britain, the summer ice of the Labrador Current chills it down to 41° Fahr. off Newfoundland and to 39° off Labrador.

The Sargasso Sea.—Prof. J. J. Stevenson lately made a voyage across the west central Atlantic from Barbadoes to the Azores and back, with a view to examining the conditions in the Sargasso sea, and thus testing the correctness of published statements as to the amount of seaweed with which the surface of the ocean is there covered. He gives the results of his observations in *Science* for December 9 last. On the outward voyage the first seaweed was seen just north of 21° N. Further south it became more abundant until the 26th parallel, but nowhere did it occur in more than isolated bunches, following usually a linear arrangement, in strips sometimes 10 feet wide, but separated by spaces of 100 to 500 feet. On the return passage (some 2° east of the outward route) comparatively few bunches, either isolated or in single lines, were seen. Prof. Stevenson received information showing that further west, between Jamaica and Southampton, the weed is more abundant,

but that the patches rarely exceed an acre in extent. The place of origin seems, Prof. Stevenson says, to be the Bahamas, among which the weed was seen by him in more abundance than on either of the lines across the Sargasso sea. He calculates that in the latter, if the bunches were brought close together, each square mile would yield a strip not more than 13 feet wide and 3 or 4 inches thick. The amount seems, however, to vary with the time of year, the accumulation being greatest when the trade winds are mild, as they were when he made the voyages.

The Natural Sources of Petroleum.—*The Cairo Scientific Journal* for September, 1910, contains an article by Dr. W. F. Hume entitled "Petroleum: Its Occurrence and Origin." The subject is discussed from the general point of view, but with special bearing upon the oil supplies occurring in Egypt. The main conclusion with regard to the origin of petroleum is this: that, while it may sometimes result from inorganic agencies associated with volcanic activity (being a by-product of very varied chemical reactions), and may also be in limited quantity of vegetable origin, the great mass of evidence supports the theory of animal origin for the large natural supplies existing in commercial quantity. Prof. Mrazec holds that the decomposition of micro-organisms in salt water is a fruitful source of petroleum. In Rumania, and it is believed also in Egypt, there are large salt deposits in close relationship with surrounding bituminous oil-bearing rocks. Nor does the presence of hydrocarbons in sea and lake water rest only upon theory, for the salt lakes of Rumania have been actually found to contain them, and in the Gulf of Genoa carbon is more constantly present as hydrocarbon than CO_2. All "commercial supplies" of petroleum are found in sedimentary rocks, either sands, clays, or limestones, over which lies an impervious clayey covering which prevents escape of oil and highly volatile gases. (At Heathfield in Sussex "natural gas" is obtained in the great sandstone formations of that part of the country.) The migration of petroleum whereby accumulations take place in special areas may be brought about by various factors. Hydrocarbons exist under high pressure, and in consequence tend to move along the lines of least resistance towards rocks capable of absorbing the most of these bodies. The most potent factor of migration seems to be the pressure due to tectonic forces resulting in folding and dislocation of the Earth's crust, for it is found that reservoirs of oil are most commonly found in association with anticlines, overfolds, overthrusts, and even faults. Oil deposits require good conditions both of accumulation and preservation.

OBITUARY.

Lieut.-Colonel Moll.

By the death of Brevet Lieut.-Colonel Moll, of the Infanterie Coloniale, killed in action at Drijele in Massalit on November 9, France adds yet another name to the long roll of intrepid soldier-administrators who have built up her African empire. Born in 1871, he entered the army in 1891. Going to Africa in 1898, under General de Trentinian, Lieut.-Colonel Moll had had a brilliant career, receiving rapid promotion. In 1903, together with Lieut.-Colonel G. S. Elliot, R.E., he deliminated the Northern Nigeria frontier from the Niger to Lake Chad, and was present at the taking of Sokoto by our troops. In 1906 he was the French Commissioner for the Kamerun-French Congo boundary, for which

survey he received the Herbert-Fournet prize of the Société de Géographie. It was only last year that he was appointed Military Commandant of the Chad region, where during the last fifteen months he must have had a strenuous time, undertaking the conquest of Wadai with all too few forces at his disposal. His death at the early age of thirty-nine will recall to many of his friends in Northern Nigeria a gallant officer, a courteous and cultured gentleman.

MEETINGS OF THE ROYAL GEOGRAPHICAL SOCIETY, SESSION 1910-1911.

RESEARCH DEPARTMENT.

December 15, 1910.—Professor J. L. Myres in the Chair.

"Distribution of Salt in the Soil of the Norfolk Broads Region." By Miss M Pallis. And "Some Observations on the Waters of the River Bure and its Tributaries." By Robert Gurney.

SPECIAL LECTURES ON INLAND TOWNS AND CITIES: THEIR MAIN ORIGINS.

By Prof. P. Geddes.

First Lecture, December 16, 1910.

Introductory: Miner and Collier as Town Makers.

Second Lecture, December 20, 1910.

Hunter and Shepherd Origins.

Third Lecture, December 22, 1910.

Peasant Origins.

Fourth Meeting, December 19, 1910.—Major Leonard Darwin, President, in the Chair.

Elections.—*Arthur Arnold; Charles Cecil Bateman; Robert Randolph Bruce; Joseph Arthur Burrell; John Charles Dowding; Dr. Walcot Gibson; A. Byers Fletcher; Charles Edwin Hack; Robert Leinster Harmsworth; Captain Austin H. W. Haywood, R.A.; John Louis Hermessen; Hugh Spencer Johnson; James Luke; Hugh M. Luttmann-Johnson; Eric Marshall; Scawin Whitworth St. Cedd; William Slater; Matthijs Spruijl; F. Philip Terry.*

The paper read was—

"The French Antarctic Expedition, 1909-1910." By Dr. J. B. Charcot.

CHRISTMAS LECTURES TO YOUNG PEOPLE.

January 2, 1911.—"Deep-sea People at Home." By Frank T. Bullen.

January 6.—"An English Lady's Experiences in Annam." By Mrs. Vassal.

January 9.—"Scenes and People in Jamaica." By Dr. Vaughan Cornish.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are as a rule written in full :—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
k.k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Adriatic. *M. k.k. G. Ges. Wien* **53** (1910): 461–475. **Brückner.**
Das italienisch-österreichische Projekt einer gemeinsamen Erforschung des Adriatischen Meeres. Von Prof. Dr. Ed. Brückner. *Sketch-map.*
See *Journal*, vol. **36**, p. 99. The map shows the currents of the Adriatic.

Alps—Cartography. *Z. Deuts. Österr. Alpenv.* **40** (1909): 1–20. **Oberhummer.**
Die ältesten Karten der Westalpen. Von Eugen Oberhummer. *Facsimile-maps.*

Alps—Erosion. *Ann. G.* **19** (1910): 289–317. **Martonne.**
L'Erosion glaciaire et la formation des Vallées alpines. Par Emm. de Martonne. *Diagrams.*

Alps—Meteorology. *Met. Z.* **27** (1910): 439–451. **Ficker.**
Ueber die Entstehung der Föhnwinde auf der Nordseite der Alpen. Von Dr. H. v. Ficker. *Diagrams.*

Alps—Morphology. **Gogarten.**
Petermanns M., Erganzungsheft **165** (1910): pp. viii. and 80.
Ueber alpine Randseen und Erosionsterrassen im besondern des Linthtales. Von Emil Gogarten. *Profiles.*

Alps—Snow. *Meteorol. Z.* **37** (1910): 289–301. **Maurer.**
Einige Ergebnisse aus Schneemessungen in den Schweizer Hochalpen und ihre Beziehungen zu den Schwankungen der Firnlinie. Von Julius Maurer. *Illustrations and Diagrams.*

Alps, Eastern—Forest-line. *Petermanns M.* **56** (1910): [i.] 63–69. **Marek.**
Beiträge zur Klimatographie der oberen Waldgrenze in den Ostalpen. Von Prof. Dr. Richard Marek.

Austria—Alpine lakes. *M. k.k. G. Ges. Wien* **52** (1909): 539–557. **Merz.**
Seestudien in den Niederen Tauern. Von Dr. Alfred Merz.

Austria—Dinaric Alps. *G. Abh. (Penck)* **9** (1910): Heft 8, pp. 230. **Grund.**
Beiträge zur Morphologie des Dinarischen Gebirges. Von Alfred Grund. *Sketch-maps and Sections. Also separate copy* (size 10½ × 7½); *presented by the Publishers.*

Austria—Lower Austria. *M. k.k. G. Ges. Wien* **53** (1910): 417–425. **Götzinger.**
Die Bergstürze des Mai 1910 in der Umgebung von Scheibbs. Von Dr. Gustav Götzinger. *Diagram and Illustrations.*

Austria—Pola—Meteorological Observations. **Hydrographisches Amt.**
Veröffentlichungen des Hydrographischen Amtes der K. und K. Kriegsmarine in Pola. Gruppe II. Jahrbuch der meteorologischen, erdmagnetischen und seismischen Beobachtungen. Neue Folge. i.–xiv. Bde.; Beobachtungen der Jahren 1896–1909. Herausgegeben von der Abteilung "Geophysik." Pola, 1897–1910. Size 13 × 10½. *Presented by the K. u. K. Hydrographischen Amt.*

Austria—Salzburg. *Sitzb. A. W. Wien* **117** (Abth. I.) (1908): 1177–1193. **Hoernes.**
Der Einbruch von Salzburg und die Ausdehnung des interglazialen Salzburger Sees. Von Rudolf Hoernes. *Section.*

Austria—Hungary—Distances. *Petermanns M.* **56** (1910): [i.] 187–188. **Kiesewetter.**
Die Meerfernen und Hafenfernen von Österreich-Ungarn. Von Prof. Dr. Joseph Kiesewetter. *Map.*

Balkan Peninsula. *M.V.E. Leipzig* 1909 (1910): 63–88. **Edlinger.**
Wanderung durch das östliche Bosnien, Montenegro und Albanien. Von Ludwig Edlinger. *Illustrations. Also separate copy, presented by the Author.* Size 9 × 6, pp. 26.

Baltic. *G.Z.* **16** (1910): 186–206. **Deecke.**
Entwicklungsgang und Gestalt der Ostsee. Von W. Deecke.

Baltic—Deposits. **Spethmann.**
Studien über die Bodenzusammensetzung der baltischen Depression vom Kattegat bis zur Insel Gotland. Von Dr. Hans Spethmann. (Arbeiten der Deutschen wissenschaftlichen Kommission für die Internationale Meeresforschung: A., Aus dem Laboratorium für internationale Meeresforschung in Kiel; Hydrographische Abteilung Nr. 8.) Kiel, 1910. Size 12½ × 10½, pp. 301–314. *Map.*

France—Rhone basin. **Kingsley.**
In the Rhone country. By Rose G. Kingsley. London: G. Allen & Sons, 1910. Size 8 × 5½, pp. x. and 308. *Illustrations. Price* 10*s.* 6*d. net. Presented by the Publishers.*

Iceland—Lava-fields. **Reck.**
Isländische Masseneruptionen. Von Hans Reck. (Geologische und Palæontologische Abhandlungen, herausgegeben von E. Kokken, neue Folge Bd. ix., Heft. 2.) Jena: G. Fischer, 1910. Size 12 × 9½, pp. 106. *Illustrations and Sections. Price* 18*s. net.*

Italy—Abruzzi. *Riv. G. Italiana* **17** (1910): 127-137. **Biasutti.**
Osservazioni morfologiche nell' Abruzzo aquilano. Cenni preliminari del Prof. R. Biasutti. *Sketch-maps.*

Italy—Earthquake. *C.R.A. Sc. Paris* **151** (1910): 418–421. **Lallemand.**
Sur les affaissements du sol causés par le tremblement de terre de Messine. Par Ch. Lallemand. *Sketch-map.*

Italy—Meteorology.
Riepilogo annuale delle osservazioni meteorologiche fatte durante l'anno 1909 nel R. Istituto Idrografico. Genoa, 1910. Size 12 × 8½, pp. 18. *Diagrams.*

Italy—Monte Amiata. *Mem. G., Riv. G. Italiana* **4** (1910): 291–364. **Dainelli.**
Studi sopra i limiti altimetrichi. II. Le zone altimetrichi del Monte Amiata. Di Giotto Dainelli. *Sketch-maps and Illustrations.*

Italy—Place-names. *B.S.G. Italiana IV.* **11** (1910): 853–859. **Pieri.**
Del nuovo e importante contributo all' indagine toponomastica, il quale ci forniscono le buste delle schede dell' ultimo Censimento, ora conservate dalla R. Accademia dei Lincei. Del prof. Silvio Pieri.

Italy—Sicily—Etna. *Nineteenth Century* **68** (1910): 105–114. **Hood.**
Etna in Eruption. By the Hon. Alexander Nelson Hood.

Italy—Strait of Messina. *Riv. G. Italiana,* **17** (1910): 138–150. **Stefani.**
Variazioni nel fondo dello Stretto di Messina constatate dopo il terremoto del 28 Dicembre 1908. Di Carlo de Stefani. *Sketch-map.*

Italy—Udine—Historical. *B.S.G. Italiana IV.* **11** (1910): 592–606. **Bertolini.**

Per la Carta storica della Patria del Friuli al cadere della Repubblica Veneta. Del prof. G. L. Bertolini.

Presents material for use as a basis for an historical map.

Mediterranean—Irrigation. *G. Teacher* **5** (1910): 266–271. **Fripp.**

Types of Irrigation in the Mediterranean Basin. By M. C. Fripp.

Northern Europe—Fisheries. **Kyle.**

Conseil Permanent International pour l'Exploration de la Mer. Bulletin statistique des pêches maritimes des pays du Nord de l'Europe. Rédigé par Harry M. Kyle. Vol. 4, pour l'année 1907. Copenhagen, 1910. Size 10½ × 8½, pp. 84.

Southern Europe—Historical. **Frothingham.**

Roman cities in Northern Italy and Dalmatia. By A. L. Frothingham. London: J. Murray, 1910. Size 8½ × 5½, pp. xx. and 344. *Sketch-map, Plans, and Illustrations. Price* 10*s.* 6*d. net. Presented by the Publisher.*

Spain. *B.R.S.G. Madrid* **52** (1910): 45–138, 180–233. **Albernas and Blázquez.**

Descripción de las costas y puertos de España de Pedro Teixeira Albernas. Por Antonio Blázquez.

Sweden. **Beerli.**

Von Rügen bis Lappland: Reiseskizzen aus Skandinavien von Dr. Hans Beerli. St. Gallen; Fehr'schen Buchhandlung 1910. Size 9 × 6, pp. 124. *Illustrations. Price* 3*m. Presented by the Publishers.*

Sweden—Fauna. *Ymer* **30** (1910): 133–140. **Ekman.**

Om människans andel i fiskfaunans spridning till det inre Norrlands vatten. Af Sven Ekman.

On the influence of man on the distribution of fish in the waters of Northern Sweden.

Sweden—Geology. *B. Geol. I. Univ. Upsala* **10** (1910): 1–80. **Högbom.**

Precambrian geology of Sweden. By A. G. Högbom. *Sketch-maps, Sections, and Illustrations.*

Sweden—Lake Wener. **Wallén.**

Meddelanden från hydrografiska Byrån. 1. Vänerns vattenståndsvariationer. Af Axel Wallén. Stockholm, 1910. Size 12 × 9½, pp. iv. and 108. *Illustration and Diagrams.* [In Swedish; French *résumé.*]

Sweden—Physical changes. *B. Geol. I. Univ. Upsala* **9** (1910): 171–182. **Fries.**

Einige Beobachtungen über postglaciale Regionenverschiebungen im nördlichsten Schweden. Von Thore Fries. *Sketch-map and Diagrams.*

On changes in the physical conditions of particular districts as evidenced by plant-remains, etc.

United Kingdom—Earthquakes. *Geol. Mag.* V. **7** (1909): 410–419. **Davison.**

The Characteristics of British Earthquakes: A Summary of Twenty-one Years' Work. By Dr. Charles Davison.

United Kingdom—Fife. **Valentine.**

Cambridge County Geographies (Scotland: edited by W. Murison). Fifeshire. By Easton S. Valentine. Cambridge University Press, 1910. Size 7½ × 5, pp. x. and 188. *Maps, Illustrations, and Diagrams. Price* 1*s.* 6*d. Presented by the Publishers.*

United Kingdom—Ireland. *P.R. Irish A.*, Sec. C. (1910): 96–106. **Coffey.**

Archæological Evidence for the Intercourse of Gaul with Ireland before the First Century. By George Coffey. *Illustrations.*

United Kingdom—Ireland—Flora. **Johnson.**

Vegetationsbilder (*Karsten and Schenck*) **8** (1910): *Plates* 25–36.

The Flora of Ireland. By Prof. Dr. T. Johnson. *Plates.* [In English and German.]

United Kingdom—Lancashire. **Bailey.**

Mem. Manchester Philos. S. **54** (1909–10): No. 15, pp. 12.

A third list of the adventitious Vegetation of the Sandhills of St. Anne's-on-the-Sea, North Lancashire. (Vice-county 60.) By Dr. Charles Bailey.

Cf. *Journal* (vol. **21**, p. 549). The second list appeared in 1907.

United Kingdom—Oxfordshire. **Tiddeman and Mill.**

Memoirs of the Geological Survey. England and Wales. The Water Supply of Oxfordshire, with records of Sinkings and Borings. By R. H. Tiddeman. With contributions on Rainfall by Dr. Hugh Robert Mill. London: Darling & Son, 1910. Size 9½ × 6, pp. 108. *Sketch-map.*

United Kingdom—Scotland—Peat Mosses. **Samuelsson.**

B. Geol. I. Univ. Upsala **10** (1910): 197–260.

Scottish Peat Mosses. A contribution to the knowledge of the late-quaternary vegetation and climate of North-Western Europe. By Gunnar Samuelsson. *Map and Illustrations.*

Investigations with a view to correlating the Scandinavian and British peat-mosses.

United Kingdom—Worcestershire. *Geol. Mag.* **V. 7** (1910): 299–302. **Wills.**

On the occurrence of Wind-worn Pebbles in High-level Gravels in Worcestershire. By Leonard J. Wills. *Illustrations.*

ASIA.

Asia—Danish Travellers. **Madsen.**

G. Ts., K. Danske G.S. **20** (1909–10): 111–117, 148–152, 196–202, 231–237, 295–301.

De vigtigste af danske foretagne Rejser og Forskninger i Asien. Af Oberst Emil Madsen.

Central Asia—Tian-Shan. *M.V.E. Leipzig* 1909 (1910): 51–62. **Merzbacher.**

Ueber Verlauf und Ergebnisse meiner neuen Forschungsreise in den Tian Schan 1907 und 1908. Von Professor Dr. G. Merzbacher. *Illustrations.*

Reports on these journeys appeared in the *Journal* for April, 1908, and March, 1909.

Central Asia—Tian-shan. *M. k.k. G. Ges. Wien* **53** (1910): 154–195. **Prinz.**

Beitrage zur Morphologie des Kuldschaer Nan-Schan. Von Dr. Gyula Prinz. *Sketch-map, Illustrations, and Sections.*

Central Asia—Tian-shan. *Petermanns M.* **56** (1910): [i.] 74–78. **Prinz.**

Vorläufiger Bericht über meine zweite mittelasiatische Reise. Von Dr. Gyula Prinz. *Map and Illustrations.*

Ceylon—Mineral Survey. **Dunstan.**

Ceylon. Report on the Results of the Mineral Survey of Ceylon, 1906-7 and 1907-8. By Professor Wyndham R. Dunstan. (Colonial Reports, Miscellaneous, No. 74, 1910.) London, 1910. Size 9½ × 6, pp. 70.

China. **Hennin.**

Publications de la Société Belge d'Etudes Coloniales. Renseignements à l'usage des voyageurs et des résidents en Chine. Rédigés à l'aide de documents inédits . . . Par Emile Hennin. (Extrait du *Bulletin de la Société Belge d'Etudes Coloniales*, 1909-1910.) Brussels, 1910. Size 9½ × 6, pp. 328. *Map. Presented by the Société Belge d'Etudes Coloniales.*

China. **Little.**

Gleanings from fifty years in China. By the late Archibald Little; revised by Mrs. Archibald Little. London: S. Low & Co., 1910. Size 8½ × 5½, pp. xviii. and 336. *Portrait and Illustrations. Price* 7*s.* 6*d. net. Presented by the Publisher.*

China—Historical. **Tschepe.**

Variétés sinologiques, No. 30. Histoire du royaume de Tsin (1106–452 [B.C.]). Par le P. Albert Tschepe, S.J. Shanghai: Imprimerie de la Mission Catholique . . . de T'ou-sè-wè, 1910. Size 10 × 6½, pp. xxii. and 438. *Presented by the T'ou-sè-wè Press.*

French Indo-China—Cambodia. **Farant.**

Astronomie cambodgienne. Par F. G. Farant. Phnom-Penh. (Saigon: F. H. Schneider), 1910. Size 10 × 7½, pp. iv. and 284. *Diagrams. Price* 20 *fr. Presented by the Author.*

India—Himalaya. **Bruce.**

Twenty years in the Himalaya. By Major the Hon. C. G. Bruce. London: E. Arnold, 1910. Size 9 × 6, pp. xiv. and 336. *Map and Illustrations. Price* 16*s. net. Presented by the Publisher.*

Japan. **Lawson.**

Highways and homes of Japan. By Lady [Kate] Lawson. London: T. Fisher Unwin, 1910. Size 9 × 6, pp. 352. *Illustrations. Price* 12*s.* 6*d. net. Presented by the Publisher.*

Japan—Agriculture. **Agricultural Bureau, Tokyo.**

Outlines of agriculture in Japan. Published by Agricultural Bureau, Department of Agriculture and Commerce, Tokyo. [Tokyo], 1910. Size 9 × 6, pp. x. and 132. *Map, Illustrations, and Diagram. Presented by the Japanese Commissioner, Japan-British Exhibition.*

Japan—Mines. **Bureau of Mines, Tokyo.**

Mining in Japan, past and present. Published by the Bureau of Mines, the Department of Agriculture and Commerce of Japan. [Tokyo], 1909. Size 10 × 6½, pp. vi. and 322. *Maps and Illustrations. Presented by the Japanese Commissioner, Japan-British Exhibition.*

Japan—Silk industry. ——

The sericultural industry in Japan. Compiled for the Japan-British Exhibition by the Japan Sericultural Association, 1910. Tokyo, [1910]. Size 10½ × 7½, pp. ii. and 158. *Maps, Portraits, and Diagrams. Presented by the Japanese Commissioner, Japan-British Exhibition.*

Persia. **Sykes.**

The glory of the Shia world; the tale of a pilgrimage. Translated and edited from a Persian manuscript by Major P. M. Sykes, assisted by Khan Bahadur Ahmad Din Khan. London: Macmillan & Co., 1910. Size 9 × 5½, pp. xiv. and 280. *Illustrations. Price* 10*s. net. Presented by the Publishers.*

See review, *ante*, p. 200.

AFRICA.

Abyssinia. **Faïtlovitch.**

Quer durch Abessinien: meine zweite Reise zu den Falaschas. Von Dr. Jacques Faïtlovitch. Berlin: M. Poppelauer, 1910. Size 9½ × 6½, pp. xvi. and 188. *Map and Illustrations. Price* 5*m. Presented by the Publisher.*

Abyssinia—Railways. *Jb. G.-Ethnogr. Ges. Zürich* 1909–10 (1910): 113–134. **Ilg.**

Zur Geschichte der äthiopischen Eisenbahnen. Von Alfred Ilg.

Abyssinia and Sudan. *M. k.k. G. Ges. Wien* **53** (1910): 313–364. **Bieber.**

Reise durch Äthiopien und den Sudan. Von Friedrich J. Bieber. *Illustrations.*

Africa—Phytogeography. *C.R. XI^e Congrès Int. G.* **2** (1910): 548–562. **Engler.**

Les Divisions phytogéographiques de l'Afrique. Par le Prof. Dr. A. Engler.

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Algeria. **Hyam.**

Biskra, Sidi-Okba and the desert. A practical handbook for travellers. By Joseph C. Hyam. Algiers: Hyam & Co., 1910. Size 6½ × 5, pp. xii. and 102. *Maps and Illustrations. Presented by the Author.*

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Militärgeographische Skizze der algerisch-marokkanischen Grenzgebiete. Von Oberstleutnant z. D. Hübner. *Map.*

Belgian Congo—Language. **Butaye.**

Grammaire congolaise. Par le P. [R.] Butaye, S.J. Roulers: J. de Meester, 1910. Size 8½ × 5½, pp. 90. *Presented for the Author by Rev. I. Struyf.*

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Abhandlungen des Hamburgischen Kolonialinstituts, Band I. Handwerk und Industrie in Ostafrika: Kulturgeschichtliche Betrachtungen von Dr. Franz Stuhlmann. Nebst einem Anhang: Die Gewinnung des Eisens bei den Nyamwezi, von R. Stern. Hamburg: L. Friederichsen und Co., 1910. Size 11 × 7½, pp. xiv. and 164. *Sketch-maps and Illustrations. Price* 8*m. Presented by the Publishers.*

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Notes sur Port Étienne et la baie du Lévrier. Par M. Chabé.

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La pacification de la Mauritanie. Par Colonel Gouraud. *Map.*
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Mauritius—Observations. **Claxton.**
Colony of Mauritius. Annual Report of the Director of the Royal Alfred Observatory for 1909. By T. F. Claxton. N.P., N.D. Size 12½ × 8, pp. 18. *Diagram.*

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Le Maroc et ses richesses naturelles. Par Louis Gentil. *Maps and Illustrations.*

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The Geological Structure of Southern Rhodesia. By Frederic Philip Mennell. *Map and Illustration.*

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Oberflachengestaltung und Hydrographie des saharisch-sudanischen abflusslosen Gebietes. Inaugural-Dissertation zur Erlangung der Doktorwürde der hohen philosophischen Fakultät der Georg-August-Universität zur Göttingen vorgelegt von Hugo Marquardsen. Göttingen, 1909. Size 9½ × 7, pp. vi. and 48. *Map.*

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Da Broken Hill al Luapula. Del cap. Maurizio Piscicelli. *Illustrations.*

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Dans l'Est du Ouadaï. Lettres du lieutenant Maurice Delacommune. *Illustrations and Portrait.*

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Wadai: the Last of the Sudanese Sultanates. By Dr. A. H. Keane.

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La Frontière Ouadai-Darfour. Par Auguste Terrier. *Map.*
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West Africa—Ethnology. *J.R.S. Arts* **58** (1910): 715–725. **Tremearne.**
Notes on the Origin of the Filani. By Captain A. J. N. Tremearne.

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Premières explorations et conquêtes dans les Rivières du Sud. Par André Arcin.

Western Sudan. *Petermanns M., Ergänzungsheft* **166** (1910): pp. 126. **Frobenius.**
Kulturtypen aus dem Westsudan. Auszüge aus den Ergebnissen der Zweiten deutschen innerafrikanishen Forschungsexpedition nebst einem Anhang über Kulturzonen und Kulturforschung in Afrika. Von Leo Frobenius. *Maps and Illustrations.*

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Geographic influences in Alaska. By Lawrence Martin.

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Alaskan Earthquakes of 1899. By Lawrence Martin. (Reprinted from the *Bulletin* of the Geological Society of America, vol. **21**, July, 1910.) [New York, 1910.] Size 10 × 7, pp. 339–406. *Maps and Diagrams. Presented by the Author.*

America—French Settlements. **Guénin.**
Eugène Guénin. Premiers essais de colonisation: les Français au Brésil et en Floride (1530–1568). Paris: E. Bigot, 1910. Size 7½ × 4½, pp. 102. *Price 2 fr. 50 Presented by the Publisher.*

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The influence of the precious metals on American Exploration, Discovery, Conquest, and Possession. By George D. Hubbard, PH.D.

Part of a thesis for the degree of Ph.D. at Cornell University.

Canada—Alberta and Saskatchewan. **Crean.**

Department of the Interior, Canada. New North-west Exploration. Report of exploration by Frank J. P. Crean, C.E., in Saskatchewan and Alberta north of the surveyed area. Seasons 1908 and 1909. Ottawa, 1910. Size 10 × 5½, pp. 116. *Maps and Illustrations. Presented by the Department of the Interior.*

North America—Ethnology. **McClintock.**

The old north trail; or life, legends and religion of the Blackfeet Indians. By Walter McClintock. London: Macmillan & Co., 1910. Size 9 × 5½, pp. xxvi. and 540. *Map and Illustrations. Price* 15*s. net. Presented by the Publishers.*

United States—Coalfields. *U.S. Geol. Surv. B.* **415** (1910): pp. 266. **Gale.**

Coal Fields of North-western Colorado and North-eastern Utah. By Hoyt S. Gale. *Maps, Illustrations, and Sections.*

United States—Colorado—Plants. **Schneider.**

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The Distribution of Woody Plants in the Pikes Peak Region. By Prof. Edward C. Schneider. *Sketch-map.*

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The Precious Metals as a Geographic Factor in the Settlement and Development of Towns in the United States. By George D. Hubbard.

United States—Historical. *P. and T.R.S. Canada* **3** (1909): Sect. I., 87–110. **Gosselin.**

Champlain et Hudson. La découverte du lac Champlain, et celle de la rivière Hudson. A l'occasion du Tricentenaire de ces deux événements, 1609–1909. Par M. l'Abbé Auguste Gosselin.

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The Glacial Lake Missoula. By J. T. Pardee. *Sketch-map and Illustrations.*

The writer gives reasons for thinking that an ice-dammed lake formerly filled a large area in north-west Montana.

United States—Natural Resources. **Van Hise.**

The conservation of natural resources in the United States. By Charles Richard Van Hise. New York: the Macmillan Co. (London: Macmillan & Co.), 1910. Size 8 × 5½, pp. xiv. and 414. *Sketch-map, Illustrations, and Diagrams. Price* 8*s.* 6*d. net. Presented by the Publishers.*

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Geology and Ore Deposits of the Bullfrog District, Nevada. By F. L. Ransome, W. H. Emmons, and G. H. Garrey. *Maps, Plans, Sections, and Illustrations.*

United States—New Hampshire. *Appalachia* **12** (1910); 146–153. **Fergusson.**

Three Meteorological Expeditions to Mount Washington. By S. P. Fergusson. *Illustrations and Diagrams.*

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Highways and Byways of the Rocky Mountains. By Clifton Johnson. New York: (London: Macmillan & Co), 1910. Size 8 × 5½, pp. xiv. and 280. *Illustrations. Price* 8*s.* 6*d. net. Presented by the Publishers.*

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The South-west. Its Splendid Natural Resources, Agricultural Wealth, and Scenic Beauty. By N. H. Darton. *Sketch-map and Illustrations.*

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The Commercial Woods of the United States and their uses. By G. T. Surface. *Sketch-map and Illustrations.*

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The Future Wheat Supply of the United States. By Prof. M. A. Carleton. *Diagrams.*

CENTRAL AND SOUTH AMERICA.

Argentine. *Deutsche Rundschau G.* **32** (1910): 529–540. **Simon.**

Der Gran-Chako und die Pampas. Von Walter Simon. *Map.*

Argentine—Patagonia. **Stappenbeck.**

Sitzb. A.W. Wien **117** (Abt. I.) (1908): 1243–1249.

Geologische Beschreibung der Umgebung des Sees Musters in Patagonien. Von Richard Stappenbeck. *Map, Illustration, and Sections.*

The name Musters is here applied to the more western of the twin lakes drained by the Chico.

Bolivia. *Petermanns M.* **56** (1910): [i.] 136–138, 194–200. **Herzog.**

Beiträge zur Kenntnis von Ostbolivien. Von Dr. Th. Herzog. *Map and Illustrations.*

Bolivia—Archæology.

Monumentos Prehistóricos de Tiahuanacu. Homenage al XVII° Congreso de los Americanistas. La Paz, Bolivia, 1910. Size 8½ × 6, pp. [xvi. and 226]. *Plans and Illustrations.*

Brazil—Bahia—Geology. *American J. Sc.* **30** (1910): 256–263. **Branner.**

The Geology of the Serra do Mulato, State of Bahia, Brazil. By J. C. Branner. *Sketch-map and Sections.*

Patagonia and Tierra del Fuego. *B. Geol. I. Univ. Upsala* **9** (1910): 93–117. **Halle.**

On Quaternary deposits and changes of level in Patagonia and Tierra del Fuego. By Thore G. Halle. *Maps and Sections.*

Peru—Ethnology. **Farabee.**

Some customs of the Macheyengas. By William Curtis Farabee. (Reprinted from the *Proceedings of the American Antiquarian Society* for October, 1909.) Worcester, Massachusetts, 1909. Size 10 × 6½, pp. 7.

Peru—Historical. **Matienzo.**

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The Rock Forest. By the Rev. A. Miles Moss. (From the *Inca Chronicle*, vol. 2, No. 6, July, 1910.) La Fundicion, Peru, 1910. Size 9½ × 6, pp. 10–14. *Illustrations.*

On the remarkable rock-formation on the Junin Pampa.

Peru and Bolivia—Boundary. *B.I.G. Argentino* **23** [1910]: 207–272. **Sorondo.**

El litigo Perú-Boliviano y el fallo arbitral. Por Dr. M. G. Sánchez Sorondo. *Map.*

Salvador. **Barberena.**

Direccion General de Estadistica. Monografías Departamentales. Por el Doctor Santiago I. Barberena. I. Usulutan (pp. 34); II. Morazan (pp. 36); III. La Paz (pp. 32); IV. Chalatenango (pp. 56); and V. Cabañas (pp. 22). San Salvador, 1909–10. Size 9 × 6. *Presented by the Author.*

Salvador. *B.R.S.G. Madrid* **52** (1910): 234–270. **Benito.**

La Republica de El Salvador. Por D. Pablo de Benito.

South America—Pilcomayo. *B.I.G. Argentino* **23** [1910]: 86–162. **Krausse and Ayala.**

Limite argentino-paraguayo. Estudios del río Pilcomayo. Informe Memoria por D. Krausse y Elias Ayala. *Map and Illustrations.*

See note in vol. **34**, p. 91.

South America—Pilcomayo. *B.I.G. Argentino* **23** (1910): 58–85. **Schmied.**

Expedicion de Adalberto y Arnaldo Schmied á la región de los ríos Pilcomayo y Confuso en los años 1906 à 1907. Informe de Adalberto Schmied. *Maps and Illustrations.*

A note on this journey was given in vol. **31**, p. 678.

South America—Pilcomayo. *B.I.G. Argentino* **23** (1910): 25–57. **Thouars.**

Géographie du rio Pilcomayo. Par E. A. Thouars. Discussion raisonnée de la géographie du Pilcomayo basée sur les observations des explorateurs. Considerations générales sur les explorations du Pilcomayo. By the same. *Maps.*

This was written in 1906, and does not take account of recent explorations.

AUSTRALASIA AND PACIFIC ISLANDS.

Aru and Kei Islands. *Le Globe, S.G. Genève* **49** (1910): Mém. 1–38. **Roux.**

Deux Archipels voisins de la Nouvelle-Guinée: Iles Arou et Kei. Récit d'une exploration scientifique. Par le Dr. Jean Roux. *Also separate copy, presented by the Author.*

Australia—Climate and Development. **Van Cleef.**

B.G.S. Philadelphia **8** (1910): (127)–(152).

Climatic Influences in the Economic Development of Australia. By Eugene van Cleef. *Sketch-maps and Diagrams.*

Australia—Labour question. *Victorian G.J.* **26–27** (1908–9): 36–65. **Macfie.**

Are the laws of Nature transgressed or obeyed by the continuous labour of white men in the Australian tropics? By Matthew Macfie.

Insists on the need of coloured labour in the development of tropical Australia.

Ellice islands—Funafuti. *J. Linnean S. (Zoology)* **30** (1910): 388–444. **Chapman.**

On the Foraminifera and Ostracoda from soundings (chiefly Deep-water) collected round Funafuti by H.M.S. *Penguin*. By Frederick Chapman. *Illustrations.*

Kermadec islands—Vegetation. **Oliver.**

Vegetation of the Kermadec Islands. By Reginald B. Oliver. (From *Transactions of the New Zealand Institute*, vol. **42**, 1909.) Wellington, 1910. Size 9½ × 6, pp. 118–175. *Sketch-map and Illustrations. Presented by the Author.*

Noticed in the December number, 1910, p. 734.

New Guinea. *Deutsche Rundschau G.* **32** (1910): 433–442. **Bencke.**

Der heutige stand unserer Kenntnis Neu-Guineas. Von Albert Bencke. *Sketch-maps.*

New Guinea—Dutch. *Ts. k. Nederl. Aardr. Genoots.* 2 Ser. **27** (1910): 1008–1011. ——

Het Digoel-gebergte en de Juliana-top. *Profile and Illustrations.*

Referred to in the Monthly Record, vol. **36**, p. 498. Mount Juliana is a peak in the main range, east of the permanently snow-clad portion.

New South Wales—Historical. **Collins and Collier.**

An account of the English Colony in New South Wales [1788 to 1801], by David Collins. Edited, with an Introduction and Notes, by James Collier. Christchurch, London, etc.: Whitcombe & Tombs, [1910]. Size 9 × 5½, pp. xxxii. and 459. *Illustrations. Price 7s. 6d. net.*

Reprint of the second, condensed edition, brought out by the author's widow, and including the supplementary matter added after the appearance of the original work in 2 vols. 4to.

POLAR REGIONS.

Antarctic—Charcot Expedition. **Gourdon.**

Exploring the Antarctic: first published narrative of the second Charcot expedition. By Ernest Gourdon. (From *Harper's Monthly Magazine*, November, 1910.) London, etc. Size 9½ × 6½, pp. 908–915. *Illustrations.*

Antarctic—German Expedition. *Z. Ges. E. Berlin* (1910): 423–430. **Filchner.**

Die Deutsche Antarktische Expedition. Von Wilhelm Filchner.

Antarctic—German Expedition. **Filchner and others.**

Z. Ges. E. Berlin (1910): 153–158.

Plan einer deutschen antarktischen Expedition. Von Oberleutnant Wilhelm Filchner, Prof. Otto Nordenskjöld, und Albrecht Penck. *Sketch-map.*

Arctic—Eskimo. **Thalbitzer.**

G. Ts., k. Danske G.S. **19** (1907–8): 218–221; **20** (1909–10): 10–17, 213–224.

Bidrag til Eskimoernes Fortidshistorie. Af William Thalbitzer. *Illustrations.*

Greenland—Fiords. *Petermanns M.* **56** (1910): [i.] 309–314. **Engell.**

Zur Kenntnis der Fjorde Grönlands. Von Dr. Magnus C. Engell. *Maps and Illustrations.*

Greenland—Settlements. *M. k.k. G. Ges. Wien* **53** (1910): 406–416. **Engell.**

Bemerkungen über die geographische Lage der Niederlassungen in Westgrönland. Von M. C. Engell. *Maps.*

Spitsbergen. *Z. Deuts. u. Osterr. Alpenv.* **40** (1909): 109–135. **Hacker and Saar.**
Die Berge um die Klaas-Billen Bay. Von Aemilius Hacker und Dr. Günther Freiherr von Saar. *Sketch-map and Illustrations.*

Spitsbergen. *Petermanns M.* **56** (1910): [i.] 200–202. **Holmsen.**
Meine Spitzbergen-Expedition, 1909. Von Gunnar Holmsen. *Map.*

MATHEMATICAL GEOGRAPHY.

Azimuth and distance maps. *Petermanns M.* **56** (1910): 2 Halbbd. 263–264. **Müller.**
Karte der Hauptazimuth und der Entfernungen der Erdorte von gegebener Station aus. *Map.*

As an example of such maps, which are of use chiefly for seismological purposes, the writer gives one showing direction and distance lines from Stuttgart.

Cartography. *G.Z.* **16** (1910): 473–490. **Becker.**
Die Kunst in der Kartographie. Von Prof. Dr. Friedrich Becker.

Cartography—Methods. *M. k.k. G. Ges. Wien* **52** (1909): 507–538. **Romer.**
Kritische Bemerkungen zur Frage der Terraindarstellung. Von Eugen v. Romer. *Illustrations.*

Cartography—Projections. **Craig.**
Ministry of Finance, Egypt. Survey Department Paper, No. 13. The Theory of Map-projections, with special reference to the projections used in the Survey Department. By J. I. Craig. Cairo, 1910. Size 10½ × 7½, pp. ii. and 80. *Diagrams.*

See review, *ante*, p. 208.

Cartography—Projections. *G.Z.* **16** (1910): 297–318, 385–398, 441–454. **Eckert.**
Die Kartenprojektion. Von Max Eckert.

A useful outline of the history and principles of map projections.

Cartography—Relief Maps. **Peucker.**
Höhenschichtenkarten. Studien und Kritiken zur Lösung des Flugkartenproblems. Von Dr. Karl Peucker. Stuttgart: Konrad Wittwer, 1910. Size 9 × 5½, pp. 60. *Map and Diagrams. Presented by the Author.*

A reprint from the *Zeitschrift für Vermessungswesen*, 1910. It will be specially noticed elsewhere.

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Avalanches. *Jb Schweizer Alpenclub* **45**, 1909–10 (1910): 250–273. **Buss.**
Ueber die Lawinen. Von Dr. Ernst Buss.

Climatology. *B.S.G. Italiana* IV. **11** (1910): 1345–1350. **Giannitrapani.**
Il presente periodo climatico e le variazioni periodiche di Brückner. Appunti del cap. Luigi Giannitrapani.

Climatology. [Andersson.]
Die Veranderungen des Klimas seit dem Maximum der letzten Eiszeit. Eine Sammlung von Berichten unter Mitwirkung von Fachgenossen in verschiedenen Ländern herausgegeben von dem Exekutivkomitee des 11. Internationalen Geologenkongresses durch dessen Generalsekretär [Gunnar Andersson]. Stockholm: Generalstabens Lithografiska Anstalt, 1910. Size 11 × 8½, pp. lviii. and 460. *Maps, Sections, and Illustrations. Price 20s.*

Denudation. *G.Z.* **16** (1910): 365–384. **Hettner.**
Die Arbeit des fliessenden Wassers. Von Alfred Hettner.

Geological history. *Petermanns M.* **56** (1910): 2 Halbbd. 229–233. **Arldt.**
Methoden und Bedeutung der Paläogeographie. Von Dr. Th. Arldt.

Meteorology—Upper air. *Ann. Hydrographie* **38** (1910): 201–217. **Köppen.**
Aufstiege von Pilotballons auf deutschen Handelsschiffen in den Jahren 1906 bis 1908. Von W. Köppen. *Diagram.*

Meteorology—Wind. *B. Mount Weather Observatory* **2** (1910): 357–374. **Henry.**
The Changes of the Wind with Altitude. By Alfred J. Henry. *Diagrams.*

Meteorology and Oceanography. *B.S.G. Italiana* IV. **11** (1910): 812–842. **Marini.**
Lo sviluppo storico della Meteorologia e della Talassologia. Loro oggetto, indirizzo e metodo di ricerca. Dal prof. L. Marini.

Meteorology and Oceanography. *Ann. Hydrographie* **38** (1910): 145–150. ——

Monatskarten des Luftdrucks sowie der Luft- und Wassertemperatur für den Indischen Ozean nebst angrenzenden Gebieten. *Maps.*

Oceanography—Adriatic. **Steuer.**

Internat. Rev. Hydrobiologie u. Hydrographie **3** (1910): 6–16.

Veränderungen der nordadriatischen Flora und Fauna während der letzten Dezennien. Von D. Adolf Steuer. *Plan.*

Oceanography—Currents. **Dawson.**

P. and T.R.S. Canada **8** (1909): Sect. III., 179–196.

Effect of the Wind on Currents and Tidal Streams. By Dr. W. Bell Dawson.

Oceanography—Currents. **Gallé.**

Zur Kenntnis der Meeresströmungen. Von P. H. Gallé. (Koninklijk Nederlandsch Meteorologisch Instituut, No. 102. Mededeelingen en Verhandelingen, No. 9.) Utrecht, 1910. Size 10 × 6½, pp. 26. *Charts.*

Oceanography—Depths and Temperatures. ——

List of Oceanic Depths and Serial Temperatures received at the Admiralty during the year 1909. London: J. D. Potter, 1910. Size 13 × 8½, pp. 24. *Price* 1*s.*

Oceanography—Instrument. *B.I. Océanog. Monaco* **159** (1910): pp. 2. **Richard.**

Sur trois nouveaux messagers destinés aux opérations océanographiques. Par J. Richard. *Illustrations.*

Oceanography—Mediterranean. **Berget.**

B.I. Océanog. Monaco, No. 167 (1910): pp. 14.

Commission internationale pour l'exploration scientifique de la mer Méditerranée. Par Prof. Alphonse Berget.

Oceanography—Mediterranean. *B.I. Océanog. Monaco*, No. 168 (1910): pp. 10. **Joubin.**

Plan de Travaux Océanographiques à exécuter dans les stations maritimes adopté à Monaco par la Commission de la Méditerranée le 1er Avril 1910. Texte rédigé par L. Joubin.

Oceanography—Mediterranean. *B.I. Océanog. Monaco*, No. 164 (1910): pp. 6. **Joubin.**

Projet d'entente entre les Stations maritimes de la Méditerranée pour l'établissement d'un plan commun de travaux océanographiques. Par L. Joubin.

Oceanography—Mediterranean. *Mem. G., Riv. G. Italiana* **3** (1909): 277–378. **Marini.**

Materiali per la conoscenza del Mediterraneo. III. Osservazioni talassologiche fatte nello Stretto di Messina durante l'anno 1908. Di L. Marini. *Charts and Diagrams. Also separate copy* (size 9½ × 6).

Oceanography—Mediterranean. **Richard and Sirvent.**

B.I. Océanog. Monaco, No. 160 (1910): pp. 154.

Liste des opérations faites dans les parages de Monaco à bord de l'Eider et du Sténo pendant les années 1907, 1908, 1909. Par J. Richard et L. Sirvent. *Map and Illustrations.*

Oceanography—Mediterranean. ——

Società Italiana per il Progresso delle Scienze. Bollettino del Comitato Tallassografico, Num. 1. Roma, 1909. Size 10½ × 7½, pp. 16.

Gives details as to the constitution of the Committee for the Scientific Exploration of the Mediterranean.

Oceanography—Mediterranean—Tide. **Grablovitz.**

Mem. G., Riv. G. Italiana **3** (1909): 189–276.

Materiali per la conoscenza del Mediterraneo. II. Le attuali conoscenze sul fenomeno della marea nel Mediterraneo. Di G. Grablovitz. *Charts.*

Oceanography—North Atlantic. **Hautreux.**

B.I. Océanog. Monaco, No. 173 (1910): pp. 18.

Atlantique Nord. Bouteilles, Glaces et Carcasses flottantes de 1887 à 1909. Par A. Hautreux. *Charts.*

This has been noticed in the Monthly Record (vol. **36**, p. 617).

Oceanography—North Atlantic. *Ann. Hydrographie* **38** (1910): 397–417. **Petersen**

Unperiodische Temperaturschwankungen im Golfstrom und deren Beziehung zu der Luftdruckverteilung. Von Johannes Petersen. *Sketch-maps and Diagrams.*

Oceanography—North Sea. *Ts. K. Ned. Aardr. Genoots.* **27** (1910): 702–740. **Tesch.**

De physische gesteldheid der Noordzee. Door D. J. J. Tesch. *Maps and Sections.*

Oceanography—Pacific. *Ann. Hydrographie* **38** (1910): 393–397.

Temperatur- und Salzgehaltsbestimmungen aus den Oberflächen- und Tiefenschichten des südwestlichen Stillen Ozeans. (Weitere Ergebnisse der ozeanographischen Beobachtungen S.M.S. *Planet*, 1909.) *Sketch-map and Diagrams.*

Oceanography—Sea floor. *B.I. Océanog. Monaco*, No. 169 (1910): pp. 30. **Thoulet.**

Instructions pratiques pour l'établissement d'une carte bathymétrique-lithologique sous-marine. Par J. Thoulet. *Illustration.*

Oceanography—Sea-water. *Nature* **84** (1910): 87–89. **Buchanan.**

Colour of the Sea. By J. Y. Buchanan.

Oceanography—Sea-water. **Gebbing.**

Internat. Rev. Hydrobiologie u. Hydrographie **3** (1910): 50–66.

Ueber den Gehalt des Meeres an Stickstoffnährsalzen. Untersuchungsergebnisse der von der Deutschen Südpolar-Expedition (1901–1903) gesammelten Meerwasserproben. Von Dr. J. Gebbing. *Diagrams.*

Oceanography—Terms. *B.S.G. Italiana* IV. **11** (1910): 860–864. **Ricchieri.**

Nomenclatura italiana delle forme dei fondi oceanici. Relazione del prof. Giuseppe Ricchieri.

Phytogeography—Ferns. **Christ.**

Die Geographie der Farne. Von H. Christ. Jena: G. Fischer, 1910. Size $10 \times 6\frac{1}{2}$, pp. 358. *Maps and Illustrations. Price* 12*s.*

Sand. *Nature* **84** (1910): 255–261. **Phillips.**

Electrical and other properties of Sand. By Charles E. S. Phillips. *Illustrations.*

Seismology. **Hecker.**

Veröffentlichung des Konigl. Preussischen Geodätischen Institutes, Neue Folge, No. 42. Seismometrische Beobachtungen in Potsdam in der Zeit vom 1. Januar bis 31 Dezember 1908. Von O. Hecker. Berlin, 1910. Size 10×7, pp. 38. *Diagrams.*

Seismology. *P. and T.R.S. Canada* **3** (1909): Sect. III., 197–208. **Klotz.**

Microseisms. By Dr. Otto Klotz.

Seismology. *Naturw. Wochenschrift* **25** (1910): 513–520. **Szirtes.**

Pulsatorische Oszillationen der Erdrinde. Von Dr. Siegmund Szirtes. *Diagrams.*

Seismology—Model. *Quart. J. Geol. S.* **66** (1910): 346–352. **Evans.**

An Earthquake Model. By Dr. John William Evans. *Diagrams.*

An ingenious model illustrating the effects produced by fracture due to a slowly accumulating strain, such as seems to have caused the Californian earthquake of 1906.

Snow. *Z. Gletscherkunde* 4 (1910): 351–355. **Jaeger.**

Allerlei Beobachtungen über Schnee- und Zackenfirn (Büsserschnee). Von Fritz Jaeger.

Tides. **Van der Stok.**

Elementaire Theorie der Getijden: Getijd-constanten in den Indischen Archipel. Von Dr. J. P. Van der Stok. (Koninklijk Nederlandsch Meteorologisch Instituut, No. 102. Mededeelingen en Verhandelingen, No. 8.) Utrecht, 1910. Size $10 \times 6\frac{1}{2}$, pp. 122. *Charts and Diagrams.*

Volcanoes. *Geol. Mag.* V. **7** (1910): 392–394. **Schwarz.**

The Fissure Theory of Volcanoes. By Prof. E. H. L. Schwarz.

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Anthropogeography. **Brunhes.**

La géographie humaine. Essai de classification positive; principes et exemples. Par Jean Brunhes. Paris: F. Alcan, 1910. Size $10 \times 6\frac{1}{2}$, pp. iv. and 844. *Maps, Illustrations, and Diagrams. Price* 20 *fr. Presented by the Publisher.*

Anthropogeography. *Petermanns M.* **56** (1910): [i] 121–123. **Scharfetter.**

Pflanzen- und Völkergrenzen. Von Prof. Dr. Rudolf Scharfetter.

Shows that plant and race boundaries coincide to some extent in Central Europe.

Anthropogeography—Teutons. **Schmidt.**

Geschichte der deutschen Stämme bis zum Ausgange der Völkerwanderung. Von Prof. Dr. Ludwig Schmidt. I. Abteilung. (Quellen und Forschungen zur alten Geschichte und Geographie, herausgegeben von W. Sieglin, Hefte 7, 10, 12, und 22.) Berlin: Weidmann, 1904–1910. Size 9½ × 6¼, pp. 492. *Maps.*

Economic—Geology and Agriculture.

Comptes Rendus de la première Conférence Internationale agrogéologique. Publié par l'Institut Géologique du Royaume de Hongrie. Budapest: Imprimerie Armand Fritz, 1909. Size 9½ × 6¼, pp. 332. *Maps and Illustrations.*

Political and Economic Geography. *G.Z.* **16** (1910): 353–365, 427–441. **Dix.**

Politische Wirtschaftsgeographie. Von Arthur Dix.

Traces the effect of economic conditions on international relations.

Historical—Drake. *B.G. Hist. et Descriptive* 1909 (1910): 396–404. **De la Roncière.**

Un Atlas inconnu de la dernière Expédition de Drake (Vues prises de son bord. Par Ch. de la Roncière. *Facsimiles.*

Noticed in the *Journal* for September, 1910, p. 363.

BIOGRAPHY.

Fleurieu. *B.S.G. Com. Bordeaux* **36** (1910): 291–301. **Doublet.**

Le Centenaire de M. Fleurieu. Par E. Doublet.

Imfeld. *Jb. Schweizer Alpenclub* **45** 1909–10 (1910): 185–204. **Heim.**

Xaver Imfeld. Von Dr. Alb. Heim.

Imfeld is known for his excellent Alpine maps and panoramas.

Parish. **Shuttleworth.**

A life of Sir Woodbine Parish, K.C.H., F.R.S. (1796–1882). By the Hon. Nina L. Kay Shuttleworth. London: Smith, Elder & Co., 1910. Size 9½ × 6¼, pp. xiv. and 454. *Portraits and Illustrations. Price 15s. net. Two copies, presented by the Publishers and Charles W. Parish, Esq.*

See review, *ante*, p. 206.

GENERAL.

Bibliography. **Baschin.**

Bibliotheca Geographica. Herausgegeben von der Gesellschaft für Erdkunde zu Berlin. Bearbeitet von Otto Baschin. Band XV., Jahrgang 1906. Berlin: W. H. Kühl, 1910. Size 9½ × 6, pp. xvi. and 536. *Presented by the Gesellschaft für Erdkunde, Berlin.*

Missions. **Strong.**

The story of the American Board: an account of the first hundred years of the American Board of Commissioners for Foreign Missions. By William E. Strong. Boston, etc.: The Pilgrim Press, 1910. Size 8½ × 5½, pp. xvi. and 524. *Maps and Illustrations. Price* $1.75 *net. Presented by the Publishers.*

The missionaries of the American board have worked in many districts (as in Portuguese West Africa) on the outskirts of civilization, and the story of their achievements contains a good deal that is of interest to the geographer. The volume is fully provided with regional maps.

Orient. **Samné and Goblet.**

Dr. Georges Samné et Y. M. Goblet. La vie politique orientale en 1909. Paris: Editions de la "Correspondance d'Orient," 1910. Size 9 × 5½, pp. xii. and 318. *Price 6 fr. Presented by M. Y. M. Goblet.*

Orthography—Arabic names. *Cairo Sc. J.* **4** (1910): 193–197. **[Crosthwaite.]**

The Transliteration of Place-names from the Arabic. [By W. H. Crosthwaite.]

Gives revised rules for use by the Survey Department, lately drawn up by a committee.

Year-Book. **Wagner.**

Geographisches Jahrbuch, XXXIII. Band, 1910 . . . herausgegeben von Hermann Wagner. Gotha: Justus Perthes, 1910. Size 9 × 6, pp. x. and 472. *Price 15 marks.*

This volume deals with recent progress in the various branches of mathematical, physical, and botanical geography.

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

Balkan Peninsula. **Kreutzbruck v. Lilienfels.**

Der Schauplatz eines zukunftigen türkisch-griechischen Konfliktes. [Von Major O. Kreutzbruck v. Lilienfels.] Scale 1 : 1,500,000 or 1 inch to 23·6 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1910, II., Tafel 45. Gotha : Justus Perthes, 1910. *Presented by the Publisher.*

British Isles—England and Wales. **Ordnance Survey.**

Sheets published by the Director-General of the Ordnance Survey, Southampton, from December 1 to 31, 1910.

1-inch (third edition). Engraved :—

In outline, 196.

Hills in black or brown, 196, 229, 244, 337. *Price* 1*s. each.*

Large Sheet Series, printed in colours, folded in cover or flat in sheets, 37, 58, 66, 67, 68.

Special Map of Winchester District ; parts of sheets 123, 124, 134, 135. *Price, on paper*, 1*s.* 6*d.* ; *mounted on linen*, 2*s.* ; *mounted in sections*, 2*s.* 6*d.*

Wolverhampton, parts of sheets 153, 154, 167, 168. *Price, on paper*, 1*s.* ; *mounted on linen*, 1*s.* 6*d.*

6-inch—County maps :—

Cheshire, 7 sheets. **Hampshire**, 30 sheets. **Kent**, 2 sheets. **Lancashire**, 3 sheets. **Lincolnshire**, 2 sheets. **Sussex**, 2 sheets. **Yorkshire**, 15 sheets. *Price* 1*s. each.*

Scale 1 : 25,000—County maps :—

Berkshire, 1 sheet. **Cheshire**, 44 sheets. **Hampshire**, 51 sheets. **Lancashire**, 8 sheets. **Sussex**, 40 sheets. **Yorkshire**, 82 sheets. *Price* 3*s. each.*

(*E. Stanford, London Agent.*)

Europe. **K. Preuss. Landesaufnahme.**

Uebersichtskarte von Mitteleuropa. Herausgegeben von der Kartogr. Abteilung der Kgl. Preuss. Landesaufnahme. Scale 1 : 300,000 or 1 inch to 4·7 stat. miles. Sheets : Brüssel ; Darmstadt ; Metz ; Stuttgart ; Trier. Berlin : R. Eisenschmidt, 1909–10. *Price* 1.50*m. each sheet.*

France. **Ministre de l'Intérieur, Paris.**

Carte de la France dressée par ordre du Ministre de l'Intérieur. Scale 1 : 100,000 or 1 inch to 1·6 stat. miles. Sheets : ix.–16, Vitré ; xii.–37, Luz ; xiv.–11, Rouen ; xv.–11, Gisors ; xvi.–24, Guéret ; xviii.–39, Banyuls-sur-mer ; xx.–10, Château-Porcien ; xx.–34, Montpellier ; xxiii.–28, Grenoble ; xxiii.–36, La Ciotat ; xxiv.–26, Chambéry ; xxiv.–27, Allevard ; xxiv.–29, Valbonnais ; xxv.–36, Bormes ; xxvii.–33, Menton. Paris : Hachette & Cie., 1910. *Price* 0.80 *fr. each sheet.*

France. **Service Géographique de l'Armée, Paris.**

Carte de France. Scale 1 : 50,000 or 1·3 inch to 1 stat. mile. Sheets : xxxiv.–17, Mirecourt ; xxxv.–8, Bruyères. Paris : Service Géographique de l'Armée, 1910. *Price* 1.50 *fr. each sheet.*

Russia. **Military Topographical Dept., St. Petersburg.**

Map of the Southern Frontier Regions of Asiatic Russia. [In Russian.] Scale 1 : 1,168,031 or 1 inch to 18·4 stat. miles. Sheets : V. Krasnoyarsk ; XIX. Tashkent ; XX. Kashgar. St. Petersburg : Military Topographical Dept, 1908–1910.

These are new editions.

Spain. **Instituto Geografico y Estadistico, Madrid.**

Provincia de Murcia. Scale 1 : 200,000 or 1 inch to 3·2 stat. miles. Madrid : Instituto Geografico y Estadistico, 1905. *Presented by Gustav Gillman, Esq.*

This is a general map, from official surveys, printed in black and red, without hill shading or contours, but showing a certain number of heights in figures. Tables of the areas of the various subdivisions are given as insets. It has been reduced from the plans of the municipal districts by the Government Survey Department, and of the whole of Spain it is the only map of a province based on accurate surveys that has been published. Of the southern and eastern portions only photo-prints of each

municipal district, on a scale of 1 : 25,000, are obtainable, without contours. A certain number of survey sheets were published some years ago comprising the country between the Guadarana and Sierra Morena ranges, printed in colours and contoured, but for a long time past no additional sheets have been issued.

Switzerland. **Geol. Komm. d. Schweizer. Naturforschenden Ges.**

Geologische Karte der Schweiz. Herausgegeben von der Geologischen Kommission der Schweizer. Naturforschenden Gesellschaft. Specialkarte No. 27*a*, Pilatus-Bürgenstock-Rigihochfluhkette von A. Buxtorf. Bl. II., Bürgenstock. Aufnahme, 1905–1908. Hierzu Profiltafel 27*b* und Erläuterungen No. 9. Scale 1 : 25,000 or 2·5 inches to 1 stat. mile. Specialkarte No. 50, Glarner-Alpen aufgenommen 1900–1908 von Jacob Oberholzer und Albert Heim. Scale 1 : 50,000 or 1·3 inch to 1 stat. mile. Spezialkarte No. 54, Umgebung des Hallwilersees u. d. Obern Winen- und Surtales aufgenommen von Dr. F. Mühlberg, 1900–1908. Mit Profiltafel 54*b* und Erläuterungen No. 10. Scale 1 : 25,000 or 2·5 inches to 1 stat. mile. Spezialkarte No. 56 *a.* u. *b.* and 57, Gebirge nördlich von Interlaken aufgenommen 1905–1909 von Paul Beck. Scale 1 : 50,000 or 1·3 inch to 1 stat. mile. Bern : A. Francke, 1910. *Presented by the Publisher.*

Switzerland. **Solca.**

Das Entwasserungsprojekt des Lüschersees und die Nollakorrektion bei Thusis in Graubunden. Eingetragen von Oberingenieur Solca in Chur. Scale 1 : 30,000 or 2·1 inches to 1 stat. mile. *Petermanns Mitteilungen*, Jahrgang 1910, II., Tafel 39. Gotha : Justus Perthes, 1910. *Presented by the Publisher.*

Turkey. **Geographical Section, General Staff.**

Turkey in Europe: Eastern and Central. Compiled in the Geographical Section, General Staff. Scale 1 : 250,000 or 1 inch to 3·9 stat. miles. 10 sheets. London : Edward Stanford; Sifton, Praed & Co.; T. Fisher Unwin, 1910. *Price* 2*s.* 6*d. net each sheet. Presented by the Director of Military Operations.*

These ten sheets can now be obtained conveniently arranged in a portfolio, and together form an excellent map of the eastern and central parts of the country, constructed from the best available material.

Indian Government Surveys. **Surveyor-General of India.**

India, showing railways, scale 1 inch to 80 miles. India and adjacent countries, scale 1 : 1,000,000, sheets 38 and 47. India and adjacent countries, scale 1 inch to 1 mile: Bengal, 9 sheets; Bengal and Eastern Bengal and Assam, 1 sheet; Berar, 6 sheets; Berar and Central Provinces, 1 sheet; Bombay and Central India, 2 sheets; Burma, 16 sheets; Central India, 5 sheets; Central India and Rajputana and United Provinces, 1 sheet; Central Provinces, 1 sheet; Central Provinces and Central India, 1 sheet; Eastern Bengal and Assam, 2 sheets; Madras, 7 sheets; Madras and Coorz, 1 sheet; Madras and Mysore, 1 sheet; North-West Frontier Provinces, 10 sheets; Punjab, 8 sheets; Punjab and Baluchistan, 2 sheets; Punjab, Kashmir, and Jammu, 1 sheet; Punjab and North-West Province, 9 sheets; Sind, 1 sheet; United Provinces, 8 sheets; United Provinces and Bengal, 1 sheet; United Provinces and Central India, 1 sheet; United Provinces and Punjab, 1 sheet. Punjab, scale 1 inch to 2 miles, 1 sheet. United Provinces, scale 1 inch to 32 miles. Calcutta : Surveyor-General's Office, 1910. *Presented by the Surveyor-General of India.*

ASIA.

Persia. **Stahl.**

Die Umgebung von Resht und der Därfek-Kuh (Nordpersien). Von A. F. Stahl. Scale 1 : 450,000 or 1 inch to 6·1 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1910, II., Tafel 46. Gotha : Justus Perthes, 1910. *Presented by the Publisher.*

Siberia. **K. Russ. Akademie der Wissenschaften.**

Fundorte von Mammut- und Nashorn-Resten in Siberien. Nach der Karte der Kaiserl. Russischen Akademie Wissenschaften, 1909. Scale 1 : 20,000,000 or 1 inch to 315·6 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1910, II., Tafel 44. Gotha : Justus Perthes, 1910. *Presented by the Publisher.*

AFRICA.

Cameroons. **Moisel.**

Karte von Kamerun. Bearbeitet von M. Moisel. Scale 1 : 300,000 or 1 inch to 4·7 stat. miles. Sheets: G 4, Baturi; H 4, Molundu. Berlin : Dietrich Reimer (Ernst Vohsen), 1910. *Price* 2*m. each sheet. Presented by the Publisher.*

Hitherto the most complete map of this region has been that in six sheets on

the scale of 1 : 1,000,000, published in the German Colonial Atlas, but owing to the survey work of recent boundary commissions, and the rapidly increasing number of route traverses of German officials, so much cartographical material is now available that it is considered that the time has come for compiling a map on the scale of 1 : 300,000. The map is generally similar in appearance with that of German East Africa on the same scale, and of Togo on 1 : 200,000, although it is produced by a different process. Like these it is published under commission, and with the support, of the German Colonial Department. Altogether the map will consist of twenty sheets and four smaller supplements, and it is to be hoped that the whole of these will be published during the next few years. The reliability of the material used in the compilation of the map necessarily varies considerably, and an inspection of the first two sheets mentioned above show that there are many blank spaces that remain to be filled in.

French Equatorial Africa. **Barrère.**

Afrique Équatoriale Française. Carte de la région Logone-Ouahm-Lobaye-Sangha. Établie d'après les travaux de la mission du Haut-Logone et des missions de Délimitation et d'Abornement Congo-Cameroun. Scale 1 : 500,000 or 1 inch to 7·8 stat. miles. 8 sheets. Paris: Henry Barrère, 1910. *Presented by the Publisher.*

An eight-sheet map of French Equitorial Africa, extending from about 3° 20′ to 9° 30′ N. lat., and from 14° 20′ to 18° 30′ E. long., with a continuation of the river Sangha to the south as far as Bomassa. A note is given on each of the sheets stating the materials upon which the mapping is based, the more important of which is mentioned in the title. A comparison of this map with one of the same region of a few years ago will show how much useful work has been done recently by the surveys and route traverses of French officers. The map is printed in colours, and shows routes in black, with hill shading in brown, and rivers blue. Numerous notes on the character of the country are also given.

Nigeria. **Geographical Section, General Staff.**

Northern and Southern Nigeria. Compiled in the Geographical Section, General Staff. Scale 1 : 2,000,000 or 1 inch to 31·5 stat. miles. London: E. Stanford; Sifton, Praed & Co; T. Fisher Unwin, 1910. *Price 3s. 6d. net. Presented by the Director of Military Operations.*

This map supplies a need that has been felt by many of a good and up-to-date map of Northern and Southern Nigeria on one sheet and on sufficiently large scale to show, in a general manner, the results of recent surveys and route traverses. The most reliable material for the construction of the map consists of the surveys of recent boundary commissions, rigorous theodolite traverses in Lagos, a line of positions fixed in latitude and telegraphic determinations of longitude between Lagos and Kano, a few latitude and azimuth traverses of fair accuracy, and marine surveys for the coast-line and creeks. To these have been adjusted the route traverses of explorers and Government officials whose duties have compelled them to travel in the country. The value of the latter varies considerably, for while in some cases they have been made with care by men who have had experience in such work, and are able to take astronomical observations with more or less accuracy for checking their maps, others are of a much rougher nature, and consist merely of unchecked compass sketches. The map is clearly drawn and printed in colours, outline and place-names black, rivers blue, boundaries and divisional names red, and tribal names green.

South Africa. **"South Africa."**

The Railway Map of South Africa. Scale 1 : 4,000,000 or 1 inch to 63·1 stat. miles. Revised to date and published by authority. London: Offices of *South Africa*, 1911. *Presented by the Publishers.*

AMERICA.

Canada. **Department of the Interior, Ottawa.**

Sectional map of Canada. Scale 1 : 190,080 or 1 inch to 3 stat. miles. Sheets: 20, Souris, revised to November 19, 1910; 69, Moosejaw, revised to November 4, 1910; 118, Rush Lake, revised to October 11, 1910; 218, Saskatoon, revised to October 12, 1910; 267, Battleford, revised to October 26, 1910; 268, Carlton, revised to October 25, 1910. Ottawa: Department of the Interior, Topographical Surveys Branch, 1910. *Presented by the Department of the Interior, Ottawa.*

Canada. **Department of the Interior, Ottawa.**

Standard Topographical map of Canada. Scale 1 : 250,000 or 1 inch to 3·9 stat. miles. Sheets: (Part of) 8 N.E., Gowganda, Ontario; (Parts of) 14 S.W., 14 S.E., and

15, Prince Edward Island, Nova Scotia, and New Brunswick. Ottawa: Department of the Interior, 1910. *Presented by the Department of the Interior, Ottawa.*

Canada. **Department of the Interior, Ottawa.**

Map of Western Canada. Scale 1 : 2,217,600 or 1 inch to 35 stat. miles. 4 sheets. Ottawa: Department of the Interior, 1910. *Presented by the Department of the Interior, Ottawa.*

An outline, without hills, of Canada west of Winnipeg and the Lake of the Woods. It is a good general map, and the indication of the railways, constructed and proposed, is a special feature. The delta of the Mackenzie river might with advantage have been more correctly drawn from the survey of Mr. A. H. Harrison, which was published in the *Geographical Journal* for March, 1908.

South America. **Wickenburg**

Eduard Graf v. Wickenburgs Reisen in Sudamerika 1907–10. Scale 1 : 25, 000,000 or 1 inch to 394·5 stat. miles. *Petermanns Mitteilungen*, Jahrgang 1910, II., Tafel 42. Gotha: Justus Perthes, 1910. *Presented by the Publisher.*

AUSTRALASIA.

Queensland. **Greenfield.**

Sketch-map of East Central Queensland Gold, Mineral, and Coal Fields between Rockhampton, Gladstone, and the Dawson and Mackenzie rivers. Prepared at the Geological Survey Office, Department of Mines, by W. H. Greenfield. Scale 1 : 253,440 or 1 inch to 4 stat. miles. Brisbane: Geological Survey, 1910. *Presented by the Queensland Geological Survey.*

GENERAL.

German Colonies. **Sprigade and Moisel.**

Grosser Deutscher Kolonialatlas. Bearbeitet von Paul Sprigade und Max Moisel. Herausgegeben vom Reichs-Kolonialamt. Lieferung 7. Berlin; Dietrich Reimer (Ernst Vohsen), 1910. *Price 3m. Presented by the Publisher.*

The seventh part of this atlas of the German colonial possessions contains sheets No. 18 (Kilimanjaro) and No. 22 (Bismarckburg) of the map of German East Africa, on the scale of 1 : 1,000,000, and sheet No. 6 of the six-sheet map of the German possessions in the Pacific ocean and Kiauchau, with plans of Kiauchau and surrounding country, 1 : 2,000,000; Kiauchau, 1 : 250,000. Samoan islands: Savái, 1 : 500,000; Upólu, 1 : 250,000; Apia harbour, 1 : 50,000. There is also a complete index to the place-names on the maps of German possessions in the Pacific and Kiauchau, published in 1909–10.

World. **Johnston.**

Historical Atlas. Thirty-two plates, printed in colours, containing forty-four maps and plans, together with historical notes and a chronological table of national history. Index to place-names. Edinburgh and London: W. & A. K. Johnston, Ltd., 1910. *Price 1s. 6d. net. Presented by the Publishers.*

A new edition of a small general historical atlas, revised and remodelled on the basis of Poole's "Historical Atlas of Modern Europe," and other works.

World. **St. Martin and Schrader.**

Atlas Universel de Géographie construit d'après les sources originales et les documents les plus récents, cartes, voyages, mémoires, travaux géodesiques, etc. Avec une texte analytique. Ouvrage commencé par M. Vivien de Saint-Martin et continué par Fr. Schrader. Carte No. 67, Egypte et Soudan Egyptien. Paris: Hachette & Cie., [1910.] *Presented by the Publishers.*

Includes Egypt, Erythria, all those portions of the Anglo-Egyptian Sudan and Abyssinia north of 8° 10′ N. lat., and both the eastern and western shores of the Red sea. It is accompanied by a sheet of letterpress giving the cartographical material used and consulted in its construction. Plans of Alexandria and Cairo are given as insets.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty.**

Charts and Plans published by the Hydrographic Department, Admiralty, during November, 1910. *Presented by the Hydrographer, Admiralty.*

New Charts—No. 2549, Plans on the east coast of Celebes: Tomori gulf, 3*s*. New **Plans and Plans added**—No. 2251, Baltic sea: Kalmar sound and Öland island. Plan added: Oskarshamn, 3*s*. 2304, Norway, west coast: Karmö to Bergen. Plan added: Noreimsund, 3*s*. 199, Adriatic: Brindisi to Ortona. Plan added: Tremiti

islands anchorage, 2*s.* 6*d.* 934, Eastern archipelago: Surabaya and Sapudi straits, etc. Plans added: Saubi road, Tianjar road. New Plans: West coast of Nusa Besar, Pabuan Amuk and Ujung road, Benoa channel, Pantai Timur and Sanur road, 3*s.* 2785, Plans on the south coast of Sumbawa island. Plans added: Nanga Miru bay, Bima bay, Sanggar or Dompo bay, Sumbawa bay, 2*s.* 2468, Plans of anchorages in Sumba, Timor, and adjacent islands. Plans added: Atapopa road, Waingapu road, Cyrus harbour, Dalolo anchorage, Palmedo road, 2*s.* 3440, Plans of anchorages between Celebes and New Guinea. Plans added: Warain road, Kulewatte bay, Sermata west point, 2*s.* **New Editions**—2675*b*, English channel, middle sheet: Plymouth to Portsmouth, 3*s.* 1698, England, south coast: Dover harbour, 3*s.* 2450, England, south coast: Portland to Owers, 3*s.* 2615, England, south coast: Portland to Christchurch, 4*s.* 2255, England, south coast: Weymouth to Portland, 3*s.* 2052, England, east coast: Harwich approaches, 3*s.* 1975, England, east coast: Kentish Knock to the West Swin, 4*s.* 1607, England, east coast: North Foreland to the Nore, 4*s.* 1610, England, east coast: North Foreland to Orfordness, 3*s.* 108, England, east coast: The Wash, 3*s.* 1406, North sea: Dover and Calais to Orfordness and Scheveningen, 3*s.* 196, The Kattegat: Nidingen to Honö, including Vinga sound and approaches to Göteborg, 3*s.* 2360, The Kattegat: Falsterbo point to Kalmar sound, 3*s.* 326 The Kattegat: Great Belt, 4*s.* 3036, Balearic islands: Harbour and anchorage of Palma, 2*s.* 165, Sicily: Sardinia to Malta, including Sicily, 3*s.* 6*d.* 2881, Gulf of Mexico: Key West harbour and approaches, 3*s.* 890, South America, east coast: Formosa to Pernambuco, 3*s.* 1849, Africa, south coast: Simons bay, 3*s.* 2149, Banka and Gaspa straits, 3*s.* 941*a*, Eastern archipelago, western portion, 3*s.* 1199, China, east coast: Kue-shan islands to the Yang-tse-Kiang, 4*s.* 214, Solmon islands, 3*s.* 329, Solomon islands: Bougainvillestrait, 3*s.*

America, North. **U.S. Weather Bureau.**

Meteorological chart of the Great Lakes, February, 1911. Washington: Department of Agriculture, U.S. Weather Bureau, 1911. *Presented by the U.S. Weather Bureau.*

Atlantic, North. **U.S. Hydrographic Office.**

Pilot chart of the North Atlantic Ocean, November, December, 1910. Washington: U.S. Hydrographic Office, 1910. *Presented by the U.S. Hydrographic Office.*

Atlantic, North. **U.S. Weather Bureau.**

Meteorological chart of the North Atlantic Ocean, February, 1911. Washington: Department of Agriculture, U.S. Weather Bureau, 1911. *Presented by the U.S. Weather Bureau.*

Atlantic, North, and Mediterranean. **Meteorological Office.**

Monthly meteorological charts of the North Atlantic and Mediterranean, December, 1910, January, 1911. London: Meteorological Office, 1910. *Price 6d. each. Presented by the Meteorological Office.*

Indian Ocean. **Meteorological Office.**

Monthly meteorological charts of the Indian Ocean, December, 1910, January, 1911. London: Meteorological Office, 1910. *Price 6d. each. Presented by the Meteorological Office.*

Indian Ocean. **U.S. Hydrographic Office.**

Pilot chart of the Indian Ocean, January, February, 1911. Washington: U.S. Hydrographic Office, 1910. *Presented by the U.S. Hydrographic Office.*

Indian Ocean. **U.S. Weather Bureau.**

Meteorological chart of the Indian Ocean, February, 1911. Washington: Department of Agriculture, U.S. Weather Bureau, 1911. *Presented by the U.S. Weather Bureau.*

Pacific, North. **U.S. Hydrographic Office.**

Pilot chart of the North Pacific Ocean, January, February, 1911. Washington: U.S. Hydrographic Office, 1910. *Presented by the U.S. Hydrographic Office.*

Pacific, North. **U.S. Weather Bureau.**

Meteorological chart of the North Pacific Ocean, January, 1911. Washington: Department of Agriculture, U.S. Weather Bureau, 1911. *Presented by the U.S. Weather Bureau.*

PHOTOGRAPHS.

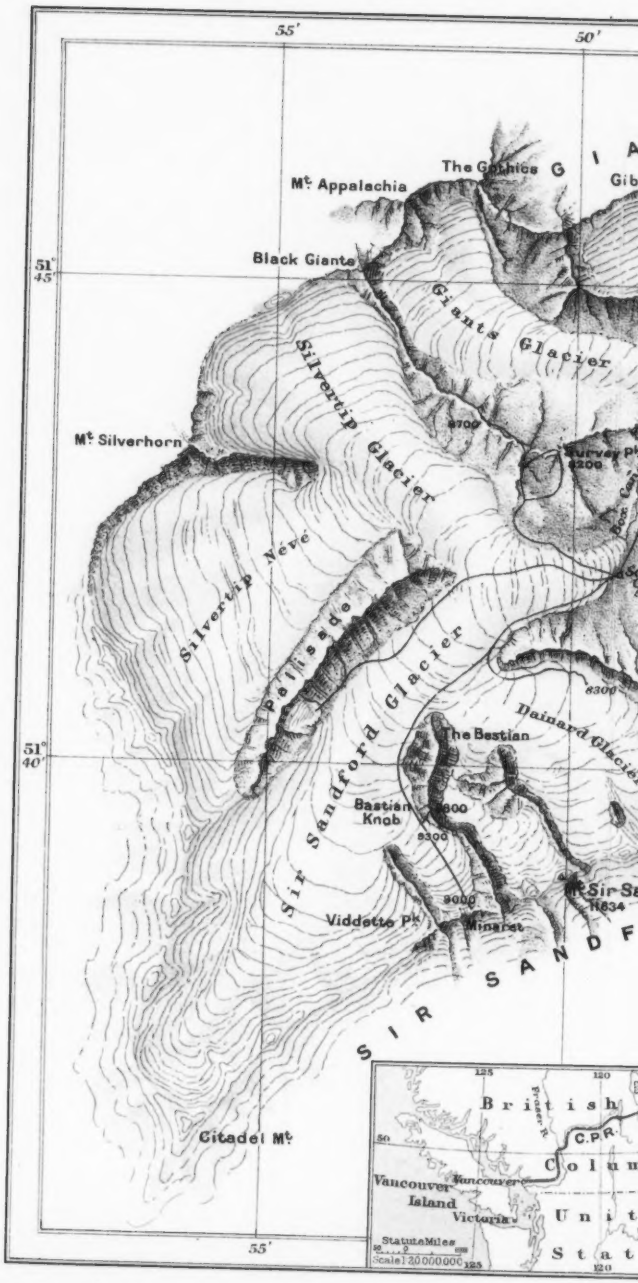
Egypt.

Four albums containing 357 photographs of the Eastern Desert of Egypt, 1900. *Presented by E. W. Streeter, Esq.*

The region represented by these photographs lies between Edfu and Aswan on the Nile and the Red sea coast, and includes the interesting old emerald mines in the neighbourhood of Sikait, to which Mr. Streeter dispatched an expedition about ten years ago. The photographs were taken during the expedition, and many of them are most characteristic of the region, while the sites of old workings are specially interesting.

(1) Our base at Darau; (2) Candidates for employment, Darau; (3) G. Sufra, Wadi Shait, limestone formation; (4) First water after leaving the Nile, Um Selim Galt; (5) The well at Abu Had; (6, 9, and 10) Ruins at Abu Had; (7 and 8) Wadi and peak in the Abu Had range; (11) Carved stones and old ruins of mining settlement near Abu Had; (12–15 and 18) Camp at Wadi Sikait; (16) Departure of caravan from Wadi Sikait; (17) Camp by moonlight, Wadi Sikait; (19) G. Um Harba from Wadi Sikait; (20) Sacred tree in Wadi Sikait; (21) Pass between G. Sikait and Um Harba; (22) Wadi Sikait and G. Sikait; (23–27 and 30) G. Sikait; (28 and 29) The western face of G. Sikait; (31 and 32) Pass Nagub, Sikait to Wadi Abu Raschîd; (33, 34, 36–38) Wadi Sikait; (35) Gorge on western slope of G. Sikait; (39) Artificial galt on west side of G. Sikait; (40) Gorge from Wadi Sikait leading to Sikait well; (41) Sikait well; (42–45) Old mines and Roman camp on G. Sikait; (46) Um Harba from the old watch tower; (47) G. Um Harba; (48 and 49) Mine on Roman Hill; (50–52, 55–57) Old mine, G. Sikait; (53) Northern camp, G. Sikait; (54) Old shaft above northern camp; (58) Rock gorge, G. Sikait; (59 and 60) Wadi Sikait, showing old well in Bander Sikait; (61 and 62) Road from Bander Sikait to Nugrus; (63 and 64) Bander Sikait and old temple; (65–68) Bander Sikait; (69–72) Main temple, Bander Sikait; (73 and 74) Old buildings, Bander Sikait; (75 and 76) Western mine, Sikait; (77–82) Shaft of Western mine, Sikait; (83–86) Old workings of Western mine, Sikait; (87) Old shafts of Western mine, Sikait; (88) Wadi Sikait, Central mines in the distance; (89 and 90) Adit to Central mines, Wadi Sikait; (91) Um Harba ruins; (92 and 93) Old mines, Um Harba; (94–100) Bander Nugrus and main lines; (101) Entrance to No. 9 mine in Zebara; (102) Sibrit wells; (102 and 123) A. A. Forster; (104 and 125) D. MacAlister; (105–117) Camp life, Sikait; (118) Hassan, native camel-man; (119) Saâd, our guide; (120) Faragh Mermidon, cook's help; (121) Abdullah, an Abadhi Beduin; (122) Mahmond Bey Haliefa; (124 and 127) Railway station at Darau; (126) Sulami, our guide; (128) Sakiyeh at Darau; (192) Sheik Ali and his A.D.C.; (130 and 131) Breakfast in the desert; (132–149) Sikait camp; (150) Our postman; (151) Our shepherd; (152) Old mine and quarry, Sikait; (153) Crown of Sikait range; (154) Wadi Um Harba; (155) East slope of G. Sikait; (156 and 157) Ruins of Bander Um Harba; (158) Old mine in Um Harba; (159) Eisa-Jesus, mining expert; (160 and 161) Bander Sikait from interior of old temple; (162 and 163) Bander Sikait, old temple; (164) Bander Sikait; (165) Old ruins, Wadi Jemal and Nugrus; (166) Near the Kharboo gorge; (167) Junction of Wadi Um el Heran; (168 and 169) Old mines, Zebara; (170) Ruins, Zebara; (171) Tribal marks; (172 and 173) Wells, Wadi Sikait; (174) Old sphinx discovered in excavating old well; (175) Ruins, Bander Sikait; (176) Hauling up the sphinx from the old well; (177) Clearing out the old well; (178) Discovering old burial-grounds; (179) Gang of native Rifpans; (180–199) Selecting native workmen, Darau; (200–211) Getting ready to start, Darau; (212–253) *En route* from Darau to Wadi Sikait; (254–304) Encampments and incidents of daily life, Wadi Sikait; (305–334) Excursions in the neighbourhood of Wadi Sikait; (335) A hunter; (336) Native workman; (337) The camp; (338) Native house; (339) Streeter's shaft; (340) Native workmen; (341) Blast furnace for the smelting of copper ore and slag heaps at Wadi Narb; (342 and 343) Wadi Narb; (344) Dykes of porphyrite crossing Wadi Narb; (345) Denudation of older rocks in comparatively recent geological times, Wadi Narb; (346) Wadi Jin; (347) Seil Hosheb; (348) Panorama from G. Musa; (349) Djebil Katharîn and Seil Leja; (350) Wadi Er-Raha; (351) Carboniferous sandstone mountains at Wadi Tigue; (352) Wadi Tgneh; (353) Beduin blasting away rocks in the turquoise mine; (354) Um Zebara; (355) Northern precipice of grey granite; (356) Disintegration of huge granite boulders by mechanical and meteorological influences; (357) Disintegration of granite boulders in Wadi Joro.

N.B. It would greatly add to the value of the collection of Photographs which has been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.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50'
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The Gothics
Black Giants
51° 45'
Giants Glacier
Silvertip Glacier
Mt. Silverhorn
8700
Silvertip Névé
Palisade
Sir Sandford Glacier
8300
Dainard Glacier
The Bestian
51° 40'
Bastian Knob
8300
9000
Viddette Pk.
Minaret
SIR SANDF
Citadel Mt.
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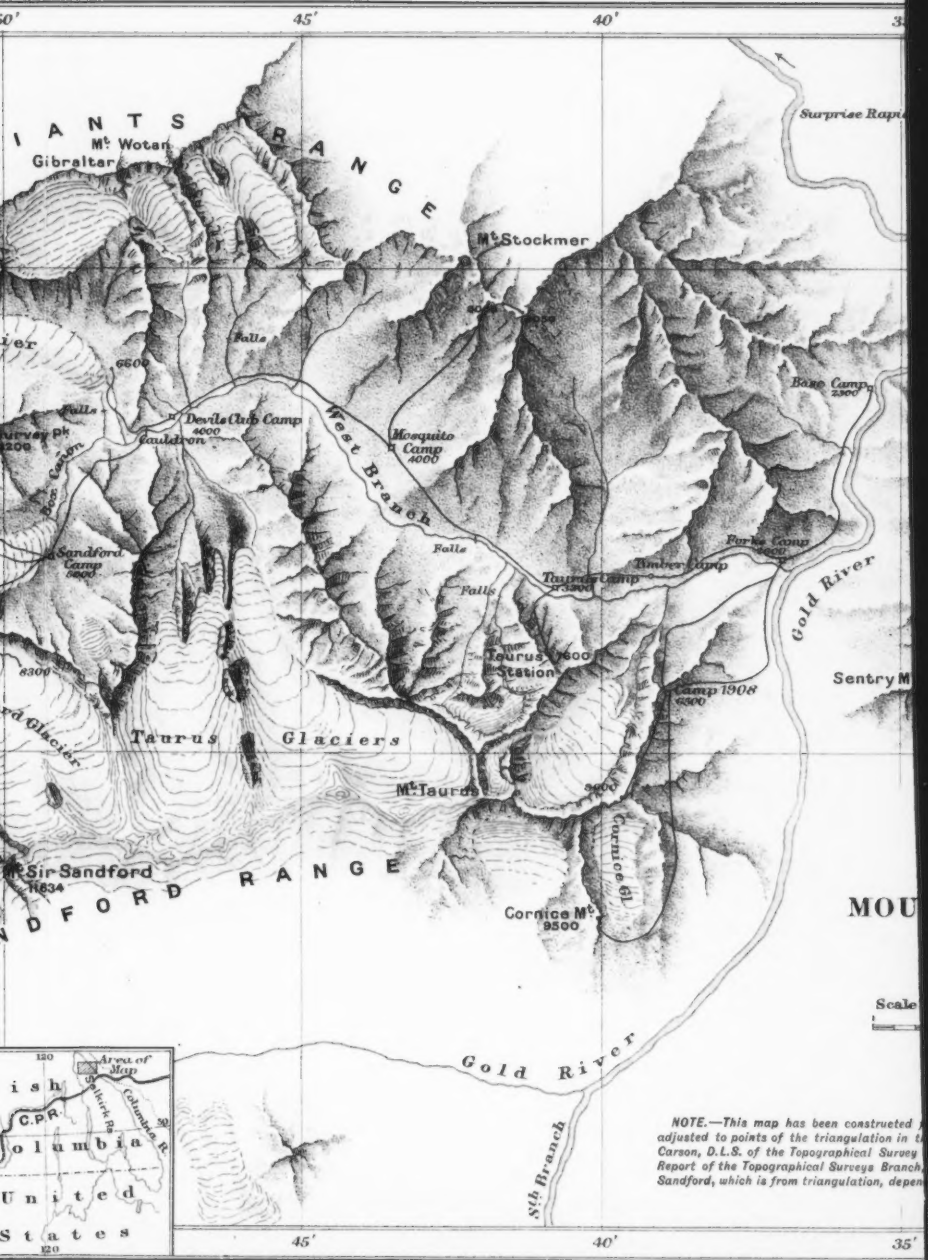

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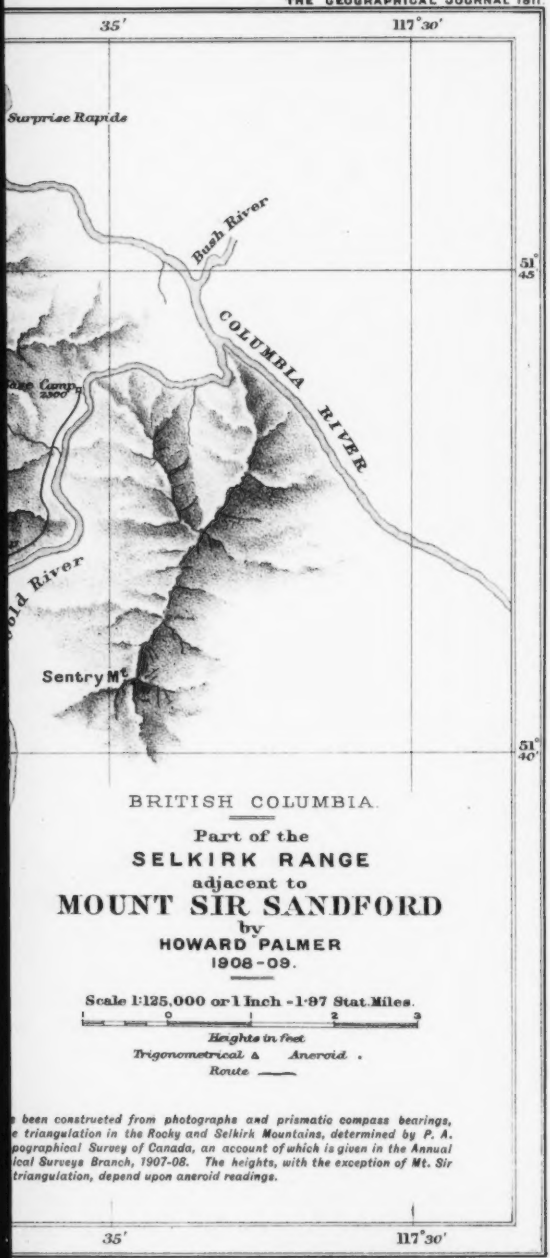

BRITISH COLUMBIA.

Part of the

SELKIRK RANGE

adjacent to

MOUNT SIR SANDFORD

by

HOWARD PALMER

1908-09.

Scale 1:125,000 or 1 Inch = 1·97 Stat. Miles.

0 1 2 3

Heights in feet.

Trigonometrical △ *Aneroid* .

Route ——

... been constructed from photographs and prismatic compass bearings, ... triangulation in the Rocky and Selkirk Mountains, determined by P. A. ...pographical Survey of Canada, an account of which is given in the Annual ...ical Surveys Branch, 1907-08. The heights, with the exception of Mt. Sir ... triangulation, depend upon aneroid readings.

Mt SIR SANDFORD
Palmer.